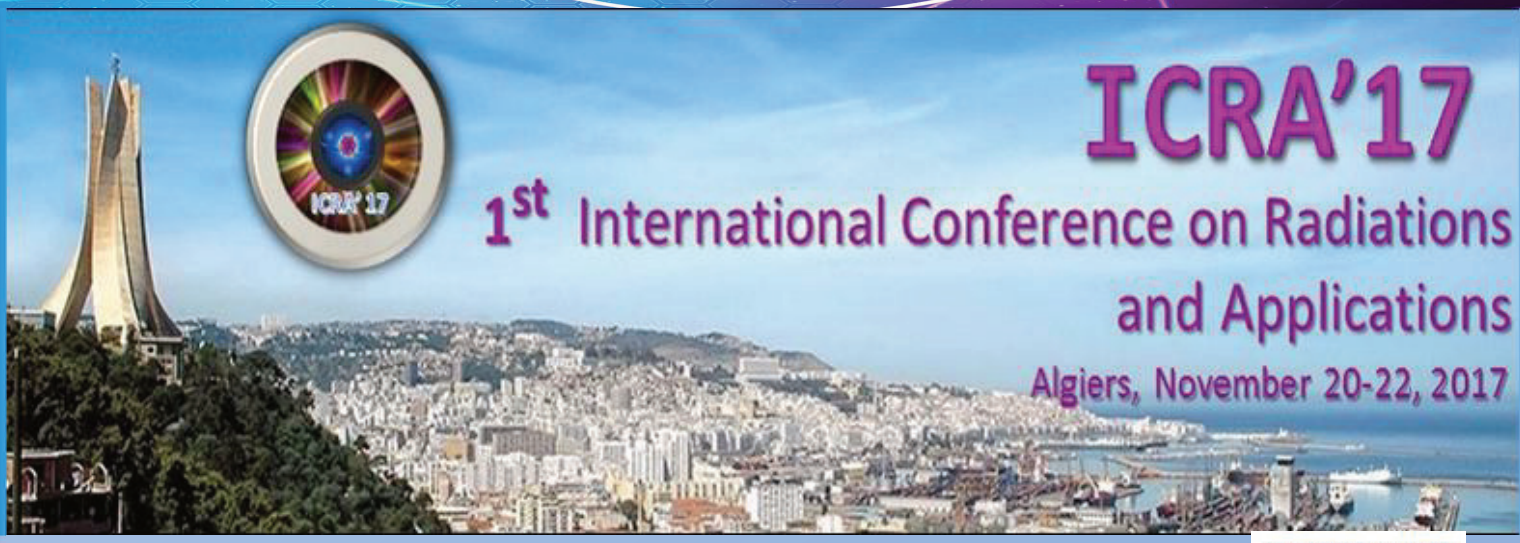
BOOK OF ABSTRACTS



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SCIENTIFIC PROGRAM

Monday November 20th, 2017	
08:00-09:00	**Registration and Reception**
09:00-09:20	**Opening Ceremonies**
09:20-10:00	**PT1 : M. Borge (Instituto de Estructura de la Materia SIC Spain; CERN, Geneva, Switzerland)** Results from ISOLDE and the HIE-ISOLDE Project
10:00-10:20	**O01: J. A. Bamikole (Federal University Lafia, Nigeria)** Parity deduction from cross section analysis of isotopes of some transuranium elements
10:20-10:50	**Coffee break**
(Session I) chair : Prof. A. Amokrane	
10:50-11:10	**O02: G. Demirelli (Antalya, Turkey)** Double differential proton emission cross sections for structural fusion materials ^{24}Mg
11:10-11:30	**O03: A. Kaplan (Isparta, Turkey)** Neutron production cross–section calculations for some gamma and proton induced reactions on ^{89}Y
11:30-11:50	**O04: E. Tel, (Osmaniye, Turkey)** Density dependent new cross section calculations of 10boron target nuclei
11:50-12:10	**O05: S. B. Gudennavar (Bengaluru, India)** K-shell internal conversion coefficient of γ-ray transition in ^{137}Ba*
12:10-12:30	**O06: A. Bozkurt (Antalya, Turkey)** Stopping power of protons for energies and materials of therapeutic importance using monte carlo simulations
12:30-12:50	**O07: S. Kaim, (Constantine university, Algeria)** Shell closure nuclei N = 82 studying and interpretation: Cerium isotopes $^{136-138}$Ce
13:00-14:00	**Lunch**
(Session II) chair : Prof. I.S. Sarpün	
14:00-14:40	**PT2 : T. Calligaro (CRRMF, Paris, France)** New trends in the application of radiations to heritage
14:40-15:00	**O08: F.B. Masok (University of Johannesburg, South Africa)** Preliminary survey of activity concentration of norm in soil samples from Richards bay, South Africa
15:00-15:20	**O09: W. Jahouach-Rabai (NCNST, Tunisia)** Radiolysis of pharmaceuticals in wastewater using irradiation technology
15:20-15:40	**O10: F. Djouider (King Abdulaziz University, Saudi Arabia)** Industrial wastewater treatment using high energy electron beam irradiation: removal of chromium (VI) heavy metal
15:40-16:00	**O11: J.N. Malaba (University of Nairobi, Kenya)** Microextraction of uranium and nuclear forensic analysis by chemometric based laser ablation molecular isotopic spectroscopy (LAMIS)

16:00-17:00	**Coffee break** **Poster Session**
(Session III) chair : Prof. A.C. Chami	
17:00-17:20	**O12: A. Hadjam (CRNB, Algeria)** Uncertainty and sensitivity analysis of LBLOCA transient in Calisto loop using SUSA code
17:20-17:40	**O13: A. Benstiti (Bordj-Bouareridj university, Algeria)** Interaction of a Gaussian laser beam with an acousto-optical cell
17:40-18:00	**O14: S. Hachani (Biskra university, Algeria)** UV-VIS spectroscopy of Eu^{3+} AND Gd^{3+} ions doped YPO_4

Tuesday November 21st, 2017	
(Session IV) chair : Prof. Y. Abushady	
09:00-09:40	**PT3: Dr. Y. Bouchareb (Barts NHS Trust, London, UK)** Recent advances and future directions in hybrid imaging and radionuclide therapies
09:40-10:00	**O15 : A. Toutaoui (Tizi Ouzou, Algeria)** NEMA NU-2 2012 performance evaluation of the first PET-CT system installed in Algeria
10:00-10:20	**O16: M. Fares (CRNB, Algeria)** Investigation of the initial and volume recombination losses in gamma versatile ionization chamber VGIC developed for gamma ray dosimetry
10:20-11:10	**Coffee break** **Poster Session**
(Session V) chair : Prof. H.Hidaka	
11:10-11:50	**PT4: Prof. M. Godefroid (ULB, Brussels, Belgium)** On the role of computational atomic structures in atomic spectroscopy, astrophysics and nuclear physics
11:50-12:10	**O17: N.Tuncel (Antalya, Turkey)** The dose rate measurements of C-ARM fluoroscopic X-RAY
12:10-12:30	**O18: R.Bechchar (Marrakech, Marocco)** Radiation transmission through laminated barrier for high-energy linear accelerators used in radiotherapy
12:30-12:50	**O19: A.Oulhissane (University of Tlemcen, Algeria)** Photodynamic therapy and cancers, current state and perspectives in Algeria
12:50-13:10	**O20: N. Boutaghane (University of Constantine, Algeria)** Large pixelated CZT versus conventional NaI(Tl) gamma camera
13:10-14:00	**Lunch**
(Session VI) chair : Prof. N. Tuncel	
14:00-14:40	**PT5: N. Yahlali (IFIC, Valencia, Spain)** Scintillation Detectors, from Nuclear and Particle Physics to Applied Physics Challenges
14:40-15:00	**O21: I.H. Sarpün (Antalya, Turkey)** Light charged particle emission of B_4C composites

15:00-15:20	**O22: L. Francis Maria Anand (Bengaluru, India)** K-shell jump ratio and jump factor of 3d elements by EDXRF technique
15:20-15:40	**O23: S. A. Mujahid (Islamabad, Pakistan)** Measurement of radon exhalation rate and natural radioactivity in the northern areas of Punjab, Pakistan
15:40-16:00	**O24: M. Akram (Islamabad, Pakistan)** Health hazards related to uranium concentration in drinking water collected from natural springs of the Jhelum valley, Azad Kashmir – Pakistan
16:00-17:00	**Coffee break** **Poster Session**
(Session VII) chair : Prof. A. Bozcurt	
17:00-17:20	**O25: A. Azbouche (CRNA, Algeria)** New method for determination of REEs by neutron activation analysis for soil redistribution study
17:20-17:40	**O26: Z. Bouhila (CRND, Algeria)** Trace elements investigation and quality assessment in soil samples by INAA
17:40-18:00	**O27: N. Belloul (Boumerdes university, Algeria)** Degradation mechanism of a glass/unsaturated polyester composite exposed to gamma radiation
18:00-18:20	**O28: G. E. Okungbowa (University of Benin, Nigeria)** Evaluation and optimization of treatment plans using radiobiological models

Tuesday November 21st, 2017	
(Session VIII) chair : Prof. Benoît Gall	
14:40-15:00	**O29: M. Izerrouken (CRND, Algeria)** Investigation of cable insulator resistance to γ-ray and neutron irradiation
15:00-15:20	**O30: A. Nouri (Bechar University, Algeria)** Study of the proton irradiation effect on the performances of the GAAS solar cell
15:20-15:40	**O31: Y. Bouaichaoui (CRNB, Algeria)** Thermal hydraulic transient analysis of accident scenario for vver440 using APROS-6 computer code
15:40-16:00	**O32: K. Aouragh (CRNA, Algeria)** Frequency of dicentrics in human blood irradiated in vitro
16:00-17:00	**Coffee break** **Poster Session**
(Session IX) chair : Dr. S.B. Gudennavar	
17:00-17:20	**O33: A. Boughalia (CRNA, Algeria)** Physical and biological evaluation of 3d treatment plan for prostate cancer
17:20-17:40	**O34 : M. Mezaguer-Lekouaghet (CRNA, Algeria)** Long-term consequence on kidney and liver organs of iodine-131 contaminated wistar rats (with and without thyroid
17:40-18:00	**O35: A. Maachou (CRNA, Algeria)** Development of calibration procedures of an electronic portal imaging devices A-SI 1000 used for IMRT and VMA

Wednesday November 22nd, 2017	
(Session X) chair : Dr. T. Calligaro	
09:00-09:40	**PT6: Y. Abushady, (Nuclear Engineering Department, Alexandria University, Egypt)** Nuclear Reactor Physics and Applications
09:40-10:00	**O36: H. Hidaka (Nagoya University, Japan)** Isotopic characterization for nuclear reactions in the OKLO natural reactors
10:00-10:20	**O37: S. Bentridi (Khemis miliana University, Algeria)** Dynamics of Oklo natural reactors
10:20-10:40	**O38: B. Gall (Institut Pluridisciplinaire Hubert CURIEN, France)** Modern Point of view on Oklo
10:40-11:20	**Coffee break** **Poster Session**
(Session XI) Chair : Prof. A. Kaplan	
11:20-11:40	**O39: K. Sidi Ali (CRND, Algeria)** A simplified nuclear thermalhydraulic channel model for nuclear research reactors using plate type fuel
11:40-12:00	**O40: N. Bensemma (CNRB, Algeria)** Neutron diffraction analysis of BaTi1-xMgx/3Nb2x/3 O3 (x = 0.03) composition
12:00-12:20	**O41: L. Hamidatou (CRNB, Algeria)** Determination of rare earth element (REE) in geological material by neutron activation analysis INAA and K_0-NAA
12:20-12:40	**O42: A. Bouldjedri (University of Batna)** Triaxial rotor model with rigid moments of inertia
12:40-13:00	**O43: H.H. Saleh (Al-Hussein Bin Talal University, Jordan)** Energy absorption buildup factors and exposure buildup factors variations with depth for biological matrices in photon energies 0.05 to 3 MeV.
13:00-14:00	**Cloture ceremonies and Lunch**
14:00	**Excursion**
19:00-21:00	**Conference Dinner**

ORAL SESSIONS

PT1: RESULTS FROM ISOLDE AND THE HIE-ISOLDE PROJECT

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Abstract

ISOLDE is the CERN facility dedicated to the production of radioactive ion beams for many different experiments in the fields of nuclear and atomic physics, materials science and life sciences. The ISOL method involves in this case the bombardment of a thick target with an intense proton beam, producing high yields of exotic nuclei with half-lives down to the millisecond range. By a clever combination of target and ion source units pure beams of over 1000 different nuclei of 75 elements have been produced and delivered to experiments where properties of the nuclei such as masses, radii, decay modes, structure and shapes are determined. Since more than ten years ISOLDE offers the largest variety of post-accelerated radioactive beams in the world today.

The HIE-ISOLDE upgrade (HIE stands for High Intensity and Energy), intends to improve the experimental capabilities at ISOLDE over a wide front. The main feature is to boost the energy of the beams, going in steps from previous 3 MeV/u via 5.5 MeV/u to finally 10 MeV/u, and to accommodate a roughly fourfold increase in intensity.

The HIE-ISOLDE project produced its first radioactive beams in October 22nd 2015. Radioactive ^{74,76}Zn beams were accelerated to 4 MeV/u and used for Coulomb excitation studies to pin down the interplay between collective and individual degrees of freedom around N=40. The results from this day one experiment from 2015 will be illustrated together with the campaign of post-accelerated beams in 2016 that will start in September. In addition very recent ISOLDE highlights of neutron-rich nuclei will be presented.

O01: PARITY DEDUCTION FROM CROSS SECTION ANALYSIS OF ISOTOPES OF SOME TRANSURANIUM ELEMENTS

J. A. Bamikole[1], M. N. Agu[2] and P. O.Akusu[2]
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[2]*National Atomic Energy Commission, Asokoro, Abuja.*

Abstract

Coupled-channels optical model code OPTMAN is used as an alternative to experimental approach to evaluate the total reaction cross section for eight selected isotopes of heavy rotational nuclei of the transuranium elements over an energy range of 10 to 20 MeV. The selected isotopes are the $_{93}$Np^{237}, $_{94}$Pu^{238}, $_{94}$Pu^{240}, $_{94}$Pu^{241}, $_{94}$Pu^{242}, $_{95}$Am^{243}, $_{96}$Cm^{244} and $_{95}$Am^{245}. Their choice is as a result of their importance in the modern day nuclear reactor and the energy range 10 – 20 MeV is the energy range of neutron produced in neutron generators and the maximum energy possessed by neutrons which are born in fission reaction. Results show that the percentage deviation of total cross section from ENDF values obtained for this work is less than 1 % at 14 MeV and above for $_{93}$Np^{237} and at 16 MeV and above for $_{94}$Pu^{238}, $_{94}$Pu^{240}, $_{94}$Pu^{241} and $_{95}$Am^{243} while at 18 MeV and above for $_{94}$Pu^{242}, $_{96}$Cm^{244} and $_{95}$Am^{245}. This work observed that the nucleus of transuranium elements is symmetric and the activities of rotation and vibrations (β – quadrupole, octupole vibrations and γ – quadrupole vibrations) cannot be ignored. Deductions in terms of parity in the transuranium elements revealed that the effects of the collective characteristics are exhibited by the neutrons and countered by the protons. This work compared well with the 6 % of Basunia in 2009 and 5 % of Paradela in 2011 using indirect measurement based on the surrogate ratio method and ECIS code respectively and is found to agree with about 1.3 % increase in accuracy.

O02: DOUBLE DIFFERENTIAL PROTON EMISSION CROSS SECTIONS FOR STRUCTURAL FUSION MATERIALS ^{24} MG

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Abstract

In this study, double differential proton emission cross sections of ^{24}Mg target nuclei have been theoretically calculated by the TALYS 1.8 code at 14 MeV neutron incident energy. Theoretical calculated cross sections were compared with available experimental data in EXFOR library. Furthermore, in theoretical calculations direct, compound and pre-equilibrium reaction contribution have been investigated. Theoretical and experimental values are in good agreement for all emission angles.

O03: NEUTRON PRODUCTION CROSS–SECTION CALCULATIONS FOR SOME GAMMA AND PROTON INDUCED REACTIONS ON ^{89}Y

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Abstract

Neutron moderation for nuclear applications has an undeniable importance. To be able to moderate neutrons, one of the important step is to choose the convenient material. The material's response for different type of nuclear reactions, define its possibility and availability for using as a neutron moderator material. The cross–section data of a reaction, which could be expressed as the probability of a reactions occurrence, could provide many benefits in the cases of the experimental difficulties or unsuitable conditions. For such cases, theoretical calculations obtained via verified methods are highly acceptable. In this study, ^{89}Y, which is a neutron moderator material used in nuclear reactors, has been investigated and neutron production cross–section calculations for some gamma and proton induced reactions on ^{89}Y have been done in the energy interval of 6–772 MeV with two most known and accepted calculation codes, TALYS 1.8 and EMPIRE 3.2. The Two Component Exciton and Exciton models have been used within the codes, respectively. Obtained results by using both code's mentioned models and exist experimental data taken from EXFOR database have been compared with each other.

O04: DENSITY DEPENDENT NEW CROSS SECTION CALCULATIONS OF ^{10}BORON TARGET NUCLEI

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Abstract

There are many applications for Boron element such as medical, industry, energy etc. Boron neutron capture therapy (BNCT) is the most important medical aplications for cancer theraphy. In this study, by using new method, neutron induced nuclear reactions calculation of Boron target nuclei have been investigated in the incident neutron

energy at 14-15 MeV. Also the cross sections with Skyrme force parameters were calculated for ^{10}B target nuclei for neutron induced nuclear reactions. We calculated reaction cross section using Tel et al. formula with Skyrme and Skyrme like force. We compared with obtained data from EXFOR around 14-15 MeV.

O05: K-SHELL INTERNAL CONVERSION COEFFICIENT OF γ-RAY TRANSITION IN BA*137

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Abstract

An unstable nucleus disintegrates into a more stable configuration through any of radioactive decay processes such as alpha decay, beta decay and cluster decay, which leaves the product nucleus in an excited state. This excited nucleus decays further to the ground state either through a radiative process (called γ-decay) or through non-radiative process (called Internal conversion process (IC)). In IC process, the electromagnetic multipole fields of the nucleus interact with an electron from one of the orbits of daughter atom causing that to be emitted. The probability of such an event occurring is negligibly small. The vacancy created in a shell due to IC process leads to the emission of various characteristic X-rays. The IC process is quantified by defining internal conversion coefficient (ICC) as the ratio of number of internal conversion electrons to number of γ-rays emitted by the nucleus. Study of internal conversion process throws a light on the knowledge of electric or magnetic multipole character of the nucleus (electric multipole or magnetic multipole transition) and the energy dependence of multipole transitions. Precise values of ICCs are necessary in establishing the accurate decay schemes of nuclei and also provide a versatile tool for investigating various aspects of the nuclear structure. From the literature, we understand that most of previous measurements have made use of a γ-ray detector for detecting γ-rays and an electron detector for detecting conversion electrons separately to determine ICCs. Hence this procedure is too involved. Given this, in the present work, we have made an alternative effort where we measure the intensities of γ-ray and K shell X-ray photons from Ba^{137} simultaneously using HPGe detector and use the recent best values of K shell fluorescence yield for Ba^{137} to determine ICCs. From the measured intensities of K X-rays of barium and the γ-rays, we determined the K-shell internal coefficient for barium. The result was compared with available experimental values from other methods and theoretical value. The close agreement found paves an alternative way of measurement of ICCs.

O06: STOPPING POWER OF PROTONS FOR ENERGIES AND MATERIALS OF THERAPEUTIC IMPORTANCE USING MONTE CARLO SIMULATIONS

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Abstract

This study presents the results of Monte Carlo simulations to obtain stopping power of protons in energy ranges and materials of therapeutic importance. The source was modeled as a point source emitting mono-energetic pencil beam of protons. A cylinder containing the material of interest was placed in vacuum to represent the phantom, a cylinder of 30 cm radius and 100 cm height. A disk-shaped thin detector (r=2 cm) was created in this phantom to compute average values of absorbed dose and flux. Its thickness varied from simulation to simulation depending on the energy of the incoming source protons. Average flux and absorbed dose were computed in the detector cell to evaluate the value of the stopping power for the material of interest at that specific energy. The results obtained in this study are compared with the data from the NIST compilation.

O07: SHELL CLOSURE NUCLEI N = 82 STUDYING AND INTERPRETATION: CERIUM ISOTOPES $^{136-138}$CE

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Abstract

The motivation of this work is the theoretical studying of some nuclei of the shell closure (N =82), cerium isotopes $^{136-139}$Ce, in the frame of macroscopic-microscopic CNS model (Cranking Nilsson Strutinsky) which calculates the following properties: single particle energy, total energy, liquid drop energy, moments of inertia, angular momentum, electric quadrupole moments, deformation parameters, nuclei shape, potential energy surfaces (PES),…

We have studied the high spin rotational bands of these isotopes using the proposed configuration and we have found a good agreement comparing with the observed results of the recent works.

PT2: NEW TRENDS IN THE APPLICATION OF RADIATIONS TO HERITAGE

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Abstract

Radiation-based methods have long been applied in the field of cultural heritage. Indeed their intrinsic analytical qualities and above all, their non-contact and non-destructive character have made them as the first choice for the investigation of the precious relics of our culture without inducing damage. In particular, radiation science enable addressing three major issues in the field of art and archaeology: 1) identification of materials, 2) determination of provenance and 3) assessment of preservation state by evidencing signs of alteration and ageing.

The application of radiation methods to heritage has tremendously progressed over the last decades. On one hand, research conducted at large and medium scale facilities like synchrotron, ion beams accelerators and neutron sources has permitted the development of new analytical techniques, for example the multi-scale chemical and structural imaging of artworks and archeological artifacts.

On the other hand, the size and cost reduction of components employed in radiation methods (e.g. microfocus sources, X-ray optics, thermo electrically cooled and matrix detectors, etc.) has triggered the development of laboratory-based and portable instruments that can sometimes compete with larger systems. These equipments notably allow carrying out measurements in situ, for instance in museums or on archaeological excavation sites, which clearly opens up new perspectives.

The present communication will survey and illustrate these trends with two radiation-based imaging methods developed at the C2RMF that usefully complement classical imaging (e.g. Visible-UV-IR photography and X-ray radiography). These new methods provide curators, archeologist and restorers with unseen pictures that are helpful in the understanding and preservation of heritage items. The first example is the bi-dimensional scanning XRF (MA-XRF) implemented in a prototype equipment designed at the C2RMF. Its benefits are shown by the recording of invisible images of Leonardo da Vinci's paintings and the monitoring of their restorations. The second example is the less common but very powerful ion beam imaging using the PIXE, RBS and PIGE techniques that are implemented in our New AGLAE accelerator. While bearing similarities, both approach exhibits particular features and limitations that will be described

The application of radiations science to cultural is also facing new challenges. The ever growing intensity and smaller diameter of the produced radiation beams question the risk of inducing damage. The presentation will advertise current research programs and actions plans internationally developed to explore mitigations strategies for radiation damage.

References

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O08: PRELIMINARY SURVEY OF ACTIVITY CONCENTRATION OF NORM IN SOIL SAMPLES FROM RICHARDS BAY, SOUTH AFRICA.

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Abstract

Uranium-238 (^{238}U) and thorium-232 (^{232}Th) are the parent primordial nuclides who along with their progenies are sources of radiation exposure to which humans are exposed directly or indirectly. In this study, sixty soil samples were analyzed for ^{238}U and ^{232}Th concentration using neutron activation analysis (NAA). The samples were irradiated by thermal neutrons in NECSA's nuclear research reactor. The mean gross alpha and gross beta activities were found to be 597 Bq.kg^{-1} and 518 Bq.kg^{-1} respectively. The activity concentrations of primordial radionuclides (^{238}U and ^{232}Th) in the analyzed soil samples were found to be below the safety limits set out by International Council on Radiation Protection (ICRP).

O09: RADIOLYSIS OF PHARMACEUTICALS IN WASTEWATER USING IRRADIATION TECHNOLOGY

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Abstract

Widely used pharmaceutical compounds have been detected in environmental systems, essentially in water. In this purpose, the degradation efficiency of these pollutants was evaluated using an advanced oxidation process (AOP) as an alternative to conventional water treatment technologies. This process permitted the generation of radical reactions to directly degrade organic contaminants in wastewater. In fact, gamma irradiation of aqueous solutions produces several reactive radicals, essentially hydroxyl radical (˙OH), to destroy recalcitrant pollutants.

Pharmaceuticals considered in this study are paracetamol, aspirin, ibuprofen, diclofenac, fumaric acid and dichloroaniline at different concentrations 0.1-1 mmol/L, which were treated by irradiation doses from 3 to 15 kGy with 6.1 kGy/h rate by ionizing system in pilot scale ($_{60}$Co irradiator). Main parameters influencing degradation efficiency were considered in the aim to optimize total mineralization of pollutants. Variation curves of main parameters (UV absorbance, COD, pH,…) versus absorbed doses describing the experimental data were released. Preliminary degradation mechanisms are suggested based on analytical study using different techniques, namely EPR, FTIR, GC-MS and HPLC. Results revealed pharmaceuticals destruction until total mineralization, which improve the efficiency of this process in water remediation. Finally, pilot plant and industrial scale irradiation facilities improved the applicability of radiation technology on large scale.

Keywords*:AOP, Gamma irradiation, hydroxyl radical, EPR, HPLC, FTIR, GC-MS.*

O10: INDUSTRIAL WASTEWATER TREATMENT USING HIGH ENERGY ELECTRON BEAM IRRADIATION: REMOVAL OF CHROMIUM (VI) HEAVY METAL

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Abstract

Chromium(VI) heavy metal is a major water contaminant, due to its carcinogenicity, while Chromium (III) is non-toxic and is an important for human metabolism. Large quantities of Cr(VI)-contaminated wastewater are discharged into aquatic environments. The objective of this study is to evaluate the removal of Cr(VI) by $O_2^{-\bullet}$ free radicals.

The degradation of Cr(VI) was investigated by electron beam irradiation using a 2.5 MeV van de Graaff accelerator. Pulse durations of 2 µs were used. The dose obtained was 500 Gy per pulse. The bleaching of Cr(VI) was observed spectrophotometrically at 370 nm.

The degradation of Cr(VI) increased linearly with the absorbed dose. More than 99% of Cr(VI) was removed after a dose of 5 kGy at near neutral pH. A partial recovery of Cr(VI) is observed over a period of 5 ms.To explain the mechanism of this removal, a kinetic model was proposed.

This laboratory study shows that electron beam irradiation might be effective and economical in the remediation of large volumes of industrial wastewater contaminated with chromium. It is an alternative means to conventional chemical methods of treating effluents

O11: MICROEXTRACTION OF URANIUM AND NUCLEAR FORENSIC ANALYSIS BY CHEMOMETRIC BASED LASER ABLATION MOLECULAR ISOTOPIC SPECTROSCOPY (LAMIS)

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Abstract

Nuclear forensics (NF) is increasingly becoming important in nuclear security and the fight against illegal trafficking of nuclear and radiological materials (NRM). Current analytical challenges call for rapid direct methods that achieve high accuracy and discrimination of NRM of limited size. Laser induced breakdown spectroscopy (LIBS) is extremely attractive in this regard, but can neither easily perform accurate trace nor isotopic analysis. Chemometrics assisted laser ablation molecular isotopic spectroscopy (LAMIS) overcomes this as well as that of isotopic analysis limitation as the plasma exhibits large isotopic splitting (enhanced using chemometrics) due to contributions of the rotational and vibrational states of ablated molecules. We have developed a method for micro-extracting uranium from model NF scenarios by combining solid phase and dispersive liquid-liquid micro-extraction and subsequent LAMIS. A recovery of 70% was achieved. The lines identified for LAMIS were U I 682.6 nm and U II 424.4 nm. Principal component analysis (PCA) was used to discern patterns due to isotopic composition. Subsequently multivariate calibration strategies for quantitative isotope ratio estimates were developed utilizing artificial neural network (ANN) and support vector machines (SVM). We will describe our method and its application in trace uranium NF analysis and source attribution based on the isotopic characteristics.

O12: UNCERTAINTY AND SENSITIVITY ANALYSIS OF LBLOCA TRANSIENT IN CALLISTO LOOP USING SUSA CODE

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Abstract

In this paper, we studied the uncertainty and sensitivity analysis of RELAP5 results for CALLISTO loop Large Break LOCA accident using the statistical uncertainty analysis methodology namely SUSA code. This analysis was performed using a one-sided upper limit tolerance limit for the fuel cladding temperature and one-side lower limit for the critical heat flux ratio (with 0.95 probability and 0.95 confidence) respectively. According to Wilk's formula in order to reach such probability and confidence limits at least 59 code runs should be performed. Each code run includes different sets of initial and boundary conditions defined in the input for the code. The uncertain parameters are defined as random values generated from the interval of values with a defined probability distribution function. Thus, prior to performing uncertainty analysis the list of parameters that could influence the results is created, the intervals of values and probability distribution function are defined for each parameter, law of normal distribution was used to evaluate the potential margins. It is assumed that each parameter is independent and the sets of initial and boundary conditions for each code run are created. Uncertainty parameters for this case of study of CALLISTO loop stability margin calculation is presented with eleven (11) uncertain parameters were chosen. The main safety parameters for the uncertainty and sensitivity analysis of the CALLISTO loop following the LBLOCA accident are the maximum fuel cladding temperature and the minimum critical heat flux have been studied and discussed.

Keywords: *CALLISTO, LBLOCA, SUSA, RELAP5, Uncertainty, Sensitivity*

O13: INTERACTION OF A GAUSSIAN LASER BEAM WITH AN ACOUSTO-OPTICAL CELL

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Abstract

Most scientific, medical and industrial applications of lasers cannot be satisfied by a beam having a Gaussian intensity distribution in a transverse plane. In this case, it is then necessary to transform the intensity profile of the Gaussian laser beam. A solution is the introduction along its path of an acousto-optical cell (AO) whose phase profile $\phi(x,y)$ will allow, after diffraction, the desired shape in the focal plane of a lens. The spatial characteristics of the diffracted beam produced by this AO cell were studied theoretically. The complex amplitude distribution of a diffracted beam is described using Collins integral and ABCD matrix formalism. The obtained results show that the output intensity profile differs from that of the incident Gaussian beam and takes the form of a flat top beam or a hollow beam, for specific values of the acoustic pressure represented by the parameter ψ inside the AO cell and the truncation parameter K_a, defined as the ratio of the acoustic wavelength to the width of the laser beam.

O14: UV-VIS SPECTROSCOPY OF EU^{3+} AND GD^{3+} IONS DOPED YPO_4

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Abstract

This work is part of the quest for new phosphors with quantum yield greater than one under VUV excitation. It is concerned with UV-Vis spectroscopy properties study of Eu^{3+} and Gd^{3+} ions doped YPO_4. We indexed 4f energy levels of those ions and Eu^{3+} CTB. Gd^{3+} ion emission is weak and situated in UV range at 310 nm correponding to $^6P_{7/2} \rightarrow {}^8S_{7/2}$ transition. That of the Eu^{3+} ions has a strong intensity and situated in the visible range (red-orange) corresponding to $^5D_0 \rightarrow {}^7F_J$ transitions. $^6P_{7/2}$ (Gd^{3+}) and $^5D_0$ (Eu^{3+}) excited-states lifetimes are 4.21 ms and 3.47 ms respectively. Our study indicates that YPO_4 : Eu^{3+}, Gd^{3+} may have potential applications in lighting and display.

PT3: RECENT ADVANCES AND FUTURE DIRECTIONS IN HYBRID IMAGING AND RADIONUCLIDE THERAPIES.

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Abstract

Becoming an integral component in clinical setting and research institutions, Molecular Imaging and Targeted Radionuclide Therapies are playing a central role in early and faster diagnosis and treatment of modern diseases such as Cancer, Cardiovascular diseases and Brain disorders. Recent and emerging developments in imaging and therapy technology, in particular hybrid imaging systems and the fast growth of computing performance capabilities further increase its value by offering effective and safe management of patients. Moreover, it empowers researchers to develop new and better ways to treat patients by speeding up the new drugs development process and ease the translation of basic and clinical research findings into day-to-day routine practice.

Targeted radionuclide therapies are becoming an essential tool to fully eradicate diseases. These treatments are complementary to modern treatment of cancer and hormone disorders. This plenary lecture highlights major recent advances and future possible developments and trends in molecular imaging and targeted radionuclide therapies. The emphasis will be on the technological, methodological and remaining technical challenges in SPECT/CT, PET/CT, PET/MR and SPECT/MR hybrid imaging systems. Most recent radionuclide therapy research translated into clinical practice, including radioactive iodine (I-131), Ra-223, Lu-177 and Y-90 microspheres therapies and some indications of possible future treatment options will be presented. The content of the lecture is suitable for scientists, medical and biomedical professionals at all levels.

O15: NEMA NU-2 2012 PERFORMANCE EVALUATION OF THE FIRST PET-CT SYSTEM INSTALLED IN ALGERIA

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Abstract

The combination of a positron emission tomograph (PET) with an x-ray computed tomograph (CT), in a single hybrid PET-CT system plays an important role in diagnosis, staging and treatment response evaluation of a large range of tumors due to the possibility of obtaining, in a single study session an accurate spatial registration of functional (PET) and morphological (CT) images. The clinical applications of PET-CT have been expanding, mainly in oncologic diagnosis and management but the development of new radiotracers is opening a new scenario also for PET-CT in cardiology and neurology.

The evaluation of PET performance requires reproducible and reliable methods to allow the comparison of different systems using accepted measurement standards. The National Electrical Manufactures Association (NEMA) has published a series of procedures to evaluate the physical performance of PET systems.

In this work, the performance characteristics of the PET component of the Discovery IQ 3 rings PET-CT scanner are investigated according to the NEMA protocol NU2-2012. This is the first PET-CT installed in Algeria at Hôpital Chahids Mahmoudi. The NEMA NU2-2012 standard was used for spatial resolution, sensitivity, scatter fraction, image quality and count loss measurements when images were reconstructed with a new algorithm called Q-Clear.

O16: INVESTIGATION OF THE INITIAL AND VOLUME RECOMBINATION LOSSES IN GAMMA VERSATILE IONIZATION CHAMBER VGIC DEVELOPED FOR GAMMA RAY DOSIMETRY

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Abstract

Gamma ionization chambers are used for gamma flow control in nuclear reactors and reprocessing plants in and monitoring atmosphere around these facilities, this in order to protect staff. In our Laboratory Detection and Measures (***LDM/DEDIN/CRNB***, we designed, developed and characterized a ***versatile gamma ionization chamber*** (***VGIC***) to study experimentally its characteristics according to the geometry of the electrodes, the volume and pressure of the filler gas. The tests were conducted under the ***IEC*** (International Electro-technical Commission).

In this paper, we present the results obtained in the various nuclear tests for characterization and calibration that we have madeon the ***VGIC*** prototype developed in our Laboratory. To do this, three irradiators were operated at the Laboratory Calibration (***SSD/CRNA***).The first Irradiator intensive gamma (^{60}***Co: 1.25 MeV***), the second medium intensity gamma (^{137}***Cs: 0.662MeV***) and the 3rd low intensity (^{60}***Co***). Saturation curves and linearity were identified and the operating range and the sensitivity of the chamber have been deducted.

The (***I,V***) characteristics of the chamber filled, with argon gas at ***3bar*** pressure, were studied. The plateau region is reached above ***200 V*** and the detector operating voltage is found to be ***600V***. It is observed that in the plateau region the slope is constant with an increase in the exposure rate. The (***1/I, 1/V***) and (***I, l/V^2***) characteristic curves reveal the presence of the initial and volume recombination losses. The volume recombination losses are found to be smaller than the initial recombination losses.

Finally, in order to strengthen our results, we performed in the same conditions, a comparative characterization with another ionization gamma chamber type reference ***LND 504 (USA).***

Keywords: *IonizationChamber, Flux Gamma,dose rate, Sensitivity*

PT4: ON THE ROLE OF COMPUTATIONAL ATOMIC STRUCTURES IN ATOMIC SPECTROSCOPY, ASTROPHYSICS, PLASMA PHYSICS AND NUCLEAR PHYSICS

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Abstract

We will describe recent progresses and developments in computational atomic structures made within the CompAS international collaboration [1]. Variational methods describe the effect of correlation in the motion of electrons in terms of orbitals that minimize the total energy of the wave function for a multiconfiguration (MC) expansion. They constitute the method of choice for the calculation of properties and electronic parameters of bound states for complex atomic systems. With single- and double-substitutions from a multi-reference set, results of excellent accuracy have been obtained for some systems in both the non-relativistic Hartree-Fock (HF) and fully relativistic Dirac-Hartree-Fock (DHF) frameworks, using respectively the ATSP and GRASP software packages. The latter are two open source codes that encapsulate the knowledge acquired over nearly half a century and are still evolving [2]. Examples of successful challenging applications will be selected to illustrate the important role of ab initio MC(D)HF atomic physics calculations in spectroscopy, astrophysics, plasma physics and nuclear physics.

References

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O17: THE DOSE RATE MEASUREMENTS OF C-ARM FLUOROSCOPIC X-RAY SYSTEMS WITH AND WITHOUT APRON

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Abstract

C-arm fluoroscopic X-ray systems are used for a variety of diagnostic imaging and minimally invasive surgical procedures. In the operating room, they help in visualizing kidney drainage, abdominal and thoracic aortic aneurysm repair, gastroenterology, orthopedics, neurology and other procedures. There have been few studies evaluating the dose of radiation received by health professionals who use these systems. The present study was embarked upon to analyze the amount of radiation received by them using standard precautionary measures and also to bring awareness about the use of standard lead apron (5mm thick) and adequate distance for safety in everyday practice. The measurements were performed at maximum kV and mA for determination of dose rate with and without lead apron for different distances from X-ray unit at the level of patient position. The Geiger–Müller counter with end-window detector was used for measurements. Reduction of risks due to ionizing radiation can be achieved by various practices, which involve the design and usage of equipment, use of targeting devices and certain measures that can be taken by the personnel involved. So, it provides good safe usage of this type of X-ray unit.

O18: RADIATION TRANSMISSION THROUGH LAMINATED BARRIER FOR HIGH-ENERGY LINEAR ACCELERATORS USED IN RADIOTHERAPY

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Abstract

The purpose of radiation protection is to reduce doses to acceptable level. Shielding is one of the most effective means of reducing radiation exposure. For high-energy linear accelerators, the materials typically used for shielding of radiotherapy room are ordinary concrete. However, in most cases, adding metals to the primary barriers is the best alternative to shield rooms properly.

In this work, the equivalent dose distributions and the transmission factors curves through laminated barrier with concrete, iron , lead and steel , for high energy linear accelerator (> 10 MV), were studied. The required shielding thicknesses to reduce the photon dose to within acceptable limits were determined using point kernel method combined with an appropriate buildup factor. The dose buildup factors of different shielding materials were determined using the geometrical progression (GP) method. The difference of the dose equivalent attenuation between the concrete shield alone and the lead + concrete + iron + steel shielding arrangement were determined.

The obtained results are in good agreement with published data reported in the literature. Also, it was observed that the use of a laminated barrier leads to a significant reduction of transmitted doses than using concrete shield alone.

Keywords: *Shielding; Dose buildup factor; Transmission; Barrier; Linac; Dose; GP method.*

O19: PHOTODYNAMIC THERAPY AND CANCERS, CURRENT STATE AND PERSPECTIVES IN ALGERIA

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Abstract

The Photodynamic Therapy (PDT) is a technique intended to handle certain type of cancers. The application is dated 1975.

It is based on the action combined of an actionable photosensitizing molecule (PS), a light Laser of appropriate wavelength and of theoxygen naturally present in the biological environment. Laser radiation will activate PS preferentially fixed to cancer cells and causes the death of tumoral cells by releasing toxic radical species that will then alter vital targets of tumoral cells.

The PDT had its major developments in the 1980s, when several clinical teams, mainly in the USA, in Canada and in Japan showed its efficiency in the treatment of certain tumors, generally inoperable.

Given that this technique is not during the day in Algeria, in particular in the coverage of the cancer, the certain doctor's biophysicists, oncologists, dermatologists and others, want to put a lot into this domain. However, the PDT can be a standard therapeutic modality only if there is awareness of all the healthcare professionals and to benefit so on one hand from the financing granted within the framework of the cancer plan by public authorities.

This work was the subject of the dissertation of Master of Professional Medical Physics.

Keys words: Cancer, Phototherapy, Photosensitizer, Oxygen, Laser, Free Radicals, Cell Death.

O20 : LARGE PIXELATED CZT VERSUS CONVENTIONAL NAI(TL) GAMMA CAMERA

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Abstract

Semiconductor CZT detectors are deemed to outperform NaI(Tl) scintillation crystals owing to direct photon conversion, high atomic number and large band gap energy. The aim of this work is to investigate parameters reflecting imaging system performance, including the combination detector/collimator characteristics. To this end, a comparative study between NaI(Tl) scintillationcamera equipped with a standard LEHR collimator and a large pixelated CZT system with a hole matched collimator was performed using GATE Monte Carlo modeling. The preliminary comparison results of the NaI(Tl) vs large CZT systems showed a spatial resolution of 7.4 mm and 11.5 mm, sensitivity of 158.2 cpm/µCi and 1087.2 cpm/µCi, central reconstructed spatial resolution in air of 8.6 mm and 12.7 mm (using OSEM reconstruction algorithm with resolution recovery), and of 10.2 mm and 13.3 mm in water, respectively. The superior performance of the large CZT system has been demonstrated using equal hole collimator length. The preliminary results of this study show that an optimal combination of detector and collimator characteristics could be proposed for a new CZT clinical imaging system.

***Keywords**: GATE, CZT system, SPECT, parallel hole collimator.*

PT5: SCINTILLATION DETECTORS, FROM NUCLEAR AND PARTICLE PHYSICS TO APPLIED PHYSICS CHALLENGES

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Abstract

I will give an overview of the main radiation detection techniques using solid and noble gas scintillation detectors, currently used in Nuclear and Particle Physics experiments which aim at broadening our basic Physics knowledge. These experiments provide, as a by-product of the research techniques, a strong know-how for the development of broad fields of Applied Physics, mainly Medical Physics and Radiation and Environmental Protection. In my talk, I will address specifically the organic scintillators and gaseous xenon scintillators at high pressure, with examples of implementation in Nuclear and Particle experiments in development at IFIC, as the NEXT experiment for the search of neutrino-less double-beta decay with Xe-136. I will then present detector projects using similar nuclear techniques, presently developed by our group at IFIC, which have been recently funded to meet various Applied Physics challenges, namely the project TRITIUM funded by the INTERREG SUDOE European program, the project XeSPECT funded by the Spanish Ministry of Economy and Competition, and finally the Medical dosimetry projects in development within our cooperation with the University USTHB of Algiers.

O21: LIGHT CHARGED PARTICLE EMISSION OF B_4C COMPOSITES

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Abstract

Composites play an important role in the nuclear energy researches due to their excellent thermal and mechanical properties. In fission and fusion nuclear reactor structural material researches, composites, especially ceramic composites are suitable as structural materials. The mechanical strength of composites increases with temperature, in contrast to the strength of metal and ceramics.

In this study, B_4C composites, produced in Eskisehir Osmangazi University by RF plasma sputtering technique in dimension of 1cm x 1cm, used as target material to obtain light charged particle, proton, deuteron and alpha, emission spectra by MCNPX.

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022: K-SHELL JUMP FACTOR AND JUMP RATIO OF 3D ELEMENTS

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Abstract

Gamma photons when interact with matter through photoelectric effect with incident energy just above the K-shell electron binding energy, a steep increase in the photoelectric absorption energy near the K edge is seen as a saw tooth structure. The saw tooth structure demarcates the lower energy branch for L and higher shells from the upper energy branch for the K-shell. Theoretically, the ratio of photoelectric absorption cross section of the upper branch to that at the lower energy branch for a given element is the K-shell jump ratio and jump factor. We, in the present work, have experimentally determined the K- shell jump factor and jump ratio by measuring the K X-ray production cross-section and the K X-ray intensity ratio for a few pure 3d elements, Co, Ni, Cu and Zn employing a simple 2π-geometrical configuration method. Adopting this method,the target elements were excited using 32.86 keV K X-ray photons from a weak ^{137}Cs radioactive source. The emitted K X-rays from the targets were detected using a low energy HPGe X-ray detector spectrometer with a energy resolution of 200 eV at 5.9 keV. Acquired spectra were analysed origin software and determined the K X-ray intensity ratio, jump factor and jump ratio for these elements. The results from the present work were compared with reported values theoretical and experimental values establishing a close agreement. The uncertainty in the measured values of jumpfactor and jump ratio for all of the target elements is less than 2%.

O23: MEASUREMENT OF RADON EXHALATION RATE AND NATURAL RADIOACTIVITY IN THE NORTHERN AREAS OF PUNJAB, PAKISTAN

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Abstract

The track-etch detectors were used to measure the radon concentration and exhalation rates from the soil samples collected from the areas of northern Punjab, Pakistan. The radon concentrations and the radon exhalation rate were found in the ranges 30 – 270Bq.m^{-3} and 40 - 295 mBq.m^{-2}.h^{-1} respectively. The measurements of natural radioactivity in the soil samples of these areas has also been carried out using HPGe detector. The radiological hazards due the naturally occurring radionuclides were also assessed. The measured activities of ^{226}Ra, ^{232}Th and ^{40}K were found in the range of 19–40, 26–60 and 510–700 Bqkg^{-1}, respectively. The calculated absorbed dose rate in air and the annual effective dose were in the range of 45–85 nGyh^{-1} and 0.22–0.41 mSv, respectively. The values of internal and external hazard indices were in the range 0.3-0.6 and 0.2-0.5, respectively.

O24 : HEALTH HAZARDS RELATED TO URANIUM CONCENTRATION IN DRINKING WATER COLLECTED FROM NATURAL SPRINGS OF THE JHELUM VALLEY, AZAD KASHMIR – PAKISTAN

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Abstract

Besides being radioactive, uranium is also chemically toxic and may be hazardous if ingested in higher concentration. Quantitative determination of uranium in drinking water is therefore, highly desirable. In this context, drinking water samples were collected from natural springs of the Jhelum valley, Azad Kashmir. All the collected samples along with the standard were first dried over the Lexan® detectors and were then irradiated with thermal neutrons in the Pakistan Research Reactor-1 (PARR-1). After irradiation, the detectors were etched in 6M NaOH solution at 50 °C. From the measured track densities in samples and standard, uranium concentration in water samples was determined. The observed uranium concentration in the studied samples ranged from 5.55 μgL^{-1} to 164.05 μgL^{-1} with an average value of 20.88 μgL^{-1}. The comparison of observed uranium concentration with Maximum Acceptable Concentration levels set by different monitoring agencies of the world as well as with the results from other locations reported in the literature indicates that there are some samples having uranium concentration above safe limits. However, in most of the cases, uranium concentration is within safe limits as far as uranium related health hazards are concerned and that the general public is safe for using water from these springs

O25: NEW METHOD FOR DETERMINATION OF REES BY NEUTRON ACTIVATION ANALYSIS FOR SOIL REDISTRIBUTION STUDY

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Abstract

Rare Earths Elements (REEs) are good tracers for the study of the process of erosion and soil redistribution in watershed. Neutron Activation Analysis is one of the best methods for determination of REEs (La, Nd, Eu, Tb, Yb, Hf) with low detection limit. In this work, a new model was developed by using the Instrumental Neutron Activation Analysis, based on capture reaction (n,γ) corrected by the contribution (*n,fission*) reaction, for determination of REEs in the soil. A combination of an experimental approach and Monte Carlo calculation by

using MCNP5 has been used to establish the parameter of irradiation and measurement. The HPGe detector's parameters were optimized by comparing the values of efficiency measured with those obtained by Monte Carlo (MCNP5) simulations. A good agreement between Monte Carlo and experiment results was found. The irradiation parameters were measured experimentally for the φ_{th} and φ_{epi} correction by using the reaction:

$$^{197}_{79}Au + ^{1}_{0}n \xrightarrow{\sigma=98\ b} ^{198}_{79}Au + \gamma$$

For apply this model in the soil redistribution, the samples were irradiated at nuclear reactor under a neutron flux of 2.36 10^{13}cm^{-2}.s^{-1} for 04 hours and measured by gamma spectrometry, using a high resolution HPGe semi-conductor detector with (1.8 keV for ^{60}Co 1332.5 keV line). The spectra were analyzed using the Genie 2000 software dedicated to the processing of gamma spectra.

The determination of the concentrations of REEs with high precision, these results allowed us to identify areas of erosion and accumulation in the studied watershed.

Keywords: *Monte Carlo MCNP5, Irradiation and Measurement parameters,INAA,REEs, Soil redistribution.*

O26: TRACE ELEMENTS INVESTIGATION AND QUALITY ASSESSMENT IN SOIL SAMPLES BY INAA

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Abstract

In this analytical work, some components of soil samples collected in different locations were determined by instrumental neutronactivation analysis (INAA). The concentrations of more than 30 minor and trace elements (Sr, Zr, Cd, As, Ca, Br, Mo, W, Ga, La, K, Sm, Nd, Sb, Sc, Zn, Cr, Fe, Hf, Ta, Tb…) in the samples were measured. The samples were irradiated under a neutron flux of 2 × 10^{13} n cm^{-2} s^{-1}, during 6 h for long and medium half-life radioisotope determination in NUR research reactor at Draria City in Algiers, which operates at a power of 1 MW. The induced activities were counted by gamma ray spectrometry using an efficiency calibrated High Purity Germanium (HPGe) detector. Trace element concentrations were examined in top soils to evaluate the contribution of the anthropogenic sources in the enrichment of these elements in the soil surface layer. The results were compared with literature values from other countries and the obtained data in most of the case did not exceed the normal levels. For the evaluation of the performance of the assay and the meaning of the results, the z-score, was used to make a quality assessment of our study using certified reference materials (CRM). The laboratory performance is evaluated as satisfactory if Z score ≤ 2, questionable for 2 < Z score < 3 and unsatisfactory for Z score ≥ 3. The analytical results of the comparison ofour measured data with recommended values for two reference materialsfor most of the elements, in both the materials,were within ±1. The results are in good agreement with the recommendedvalue of CRM standards.

Keywords: *Instrumental neutron activation analysis (INAA), Trace element, certified reference materials (CRM), z-score.*

O27: DEGRADATION MECHANISM OF A GLASS/UNSATURATED POLYESTER COMPOSITE EXPOSED TO GAMMA RADIATION

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Abstract

The aim of this work is to understand the degradation mechanism of a glass/unsaturated polyester (UP) composite exposed to γ radiation and to establish a relation between the chemical and mechanical behaviour of this material.

Mere visual observations show a marked change in the color of the (UP) resin and the composite, relative to the irradiation dose. This change of color disappears with time and the material resumes its initial color (post-irradiation phenomenon). FT-IR spectral analysis of the irradiated resin reveals a change in its molecular structure which depends on the irradiation dose. This would involve the formation of a new oxygenated groups (OH and COOH) appears in the resin structure due to an oxidation reaction under aerobe irradiation. The peaks corresponding to the C=C of the styrene and the polyester are, also, affected by the cumulative dose, what indicate the chains rupture or cross linking. As for the results of the mechanical characterization, they revealed a cyclic character in the evolution of the engineer constants. This periodicity would indeed reflect a kind of alternation in the emergence of the two phenomena cross linking and chains rupture within the material depending on the increase in the irradiation dose.

O28: EVALUATION AND OPTIMISATION OF TREATMENT PLANS USING RADIOBIOLOGICAL MODELS

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Abstract

This study evaluated and optimized treatment plans of post mastectomy patients using radiobiological models. It is a retrospective study of twenty three (23) post mastectomy patients whose Computerised Tomography (CT) scans have gone through Computerised Treatment Planning in University of Benin Teaching Hospital (UBTH) Radiotherapy Unit from 2012 – 2014. Patients that have undergone chemotherapy were excluded from the study.

The study revealed that the treatment plans had high local tumor control on the target breast (99%); while the NTCP models for the lungs gave higher complication probability than the heart. Also, there was difference between the linear, linear-exponent and linear-plateau dose risk models for SCCP; the linear dose risk model deviates more from the other two models which was due to the fact that majority of the patients were exposed to mean dose/Equivalent Uniform Dose (EUD) greater than 5 Gy to the lung and Planning Target Volume (PTV) to the heart. In optimizing the treatment plans the fractionation schemes gave NTCP values below the Quantitative Analysis of Normal Tissue Effect in the Clinic (QUANTEC) threshold of 5% for lung and 1% for heart and thus can be recommended for clinical trials.

O29: INVESTIGATION OF CABLE INSULATOR RESISTANCE TO γ-RAY AND NEUTRON IRRADIATION

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Abstract

The present investigation reports the resistance of the polyethylene cable insulator components to γ- rays and neutrons irradiation. The studied cable is similar to that actually installed inside NUR research reactor tank, Algiers, Algeria. The γ-ray irradiation were performed using ^{60}Co source of Nuclear Research Center of Algiers (CRNA) up to a dose of 5×10^6 Gy with a dose rate of 1.2 kGy/h. Neutron irradiation were made at NUR research reactor of Nuclear Research Center of Draria (CRND) up to a thermal and fast (En >1.2 MeV) neutron fluence of 5×10^9 n/cm^2 and de 2×10^{10} n/cm^2 respectively. The γ-rays dose in this position is estimated to about 7.5 Gy. After irradiation the samples were characterized using Differential Scanning calorimetry (DSC) and Thermogravimetry

(TGA-DTA). It is concluded from the experimental data that PE insulator presents a successful behaviour under neutron and high γ-ray doses corresponding to the total exposure dose in nuclear reactor tank. But PVC jacket becomes far less durable under high γ- ray doses which affect its reliability in nuclear reactor service environment.

O30: STUDY OF THE PROTON IRRADIATION EFFECT ON THE PERFORMANCES OF THE GAAS SOLAR CELL

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Abstract

In this work, we study the effect of protons irradiation on a solar cell based on GaAs. The irradiation is modeled by the ion implantation of hydrogen ions. The implantation effect obtained is used to simulate the output characteristics of this solar cell. Interesting results are obtained showing the damage caused by the variation of the energy of the protons (increase in defects, decrease in efficiency and the current of the solar cell) to a depth of up to 6µm. However, there is not a significant change on the output parameters of the solar cell by the variation of the protons fluency.

O31: THERMAL HYDRAULIC TRANSIENT ANALYSISOF ACCIDENT SCENARIOFOR VVER440 USING APROS-6 COMPUTER CODE

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Abstract

This paper presents the results of thermal-hydraulic analyses of three accident scenario calculated using the thermal-hydraulic system codes APROS in steady-state and during the transient : Small Break Loss of Coolant Accident (SBLOCA) Steam Line Break (SLB) and double-ended guillotine break accident in supporting of Symptom Based Emergency Operating Procedures.

This kind of analyses are designed to provide the response of monitored plant parameters to identify symptoms available to the operators, timing of the loss of critical safety functions and liming of operator actions to avoid the loss of critical safety functions or core damage.

The simulation model is a complete model of VVER-440 nuclear power plant developed at VTT Technical Research Centre of Finland in cooperation with Fortum for analyses of operational occurrences, abnormal events, and design bases scenarios. It includes all main process components and their control automation devices. The model provides a significant analytical capability of APROS-6 in the field of NPP safety.

O32: FREQUENCY OF DICENTRICS IN HUMAN BLOOD IRRADIATED IN VITRO

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Abstract

Exposure to ionizing radiation can lead to alterations in the genetic heritage of the cell that can be transferred to daughter cells during cell division. Induced DNA damage will result in chromosomal aberrations despite the extremely effective repair mechanisms activated.

Chromosomal exchange type aberrations (especially dicentrics) analyzed from peripheral blood lymphocytes represent a biomarker of choice for radiation-induced lesions in a cell population and allow estimation of the dose received during accidental body irradiation.

Blood samples of healthy donors were irradiated in vitro with different doses (1-4 Gy) of 60-Cobalt gamma-rays. Human lymphocytes were cultured for 48h.The metaphase preparations are processed for Giemsa staining and analyzed by photonic microscope to scoring dicentrics.

Analysis of chromosomal aberrations in at least 200 cells for each dose, showed an increase of the frequency of dicentric chromosomes with the dose. The experimental dose-effect curve established is linear-quadratic.

Keywords: *DNA, gamma rays, lymphocyte, chromosomal aberration, dicentric, biological dosimetry.*

O33: PHYSICAL AND BIOLOGICAL EVALUATION OF 3D TREATMENT PLAN FOR PROSTATE CANCER

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Abstract

In order to evaluate the first 3D treatment plans calculated in the Radiotherapy-Oncology department of Centre Anti-cancer Blida, an in-house software was developed to compute Equivalent Uniform Dose (EUD).

28 patients were planed and treated for prostate cancer with 3D-CRT. A given dose of 70 Gy was prescribed and delivered in 38 fractions. Evaluation of these treatment plans was carried out using an in-house software based on computing EUD in case of tumor and organs at risk (OAR).

All results obtained for the treated patients show that EUD was maximum for targets and minimal for OAR compared to calculated dose given by the treatment planning system "TPS". Indeed, EUD_{mean}(Target) = 82.45 (± 1.08) Gy, EUD_{mean}(Rectum wall) = 37.16(± 1.08) Gy, EUD_{mean}(Right Femoral Head) = 19.90 (±2.35) Gy, EUD_{mean}(Left Femoral Head) = 19.92 (±2.58) Gy and EUD_{mean}(Bladder wall) = 33.20 (± 1.6) Gy. The evaluation given by computing function EUD gives a maximum value of Tumor Control Probability TCP_{mean}(Target) = 99.93 (±0.016) %.

The evaluation of 3D plans is useful for physicist. For this purpose, the developed in-house software has been validated for prostate cancer and can be used for others type of cancer.

Keywords: *Conformal Therapy " 3D-RTC" , Equivalent Uniform Dose "EUD", Tumor Control Probability "TCP"*

O34: LONG-TERM CONSEQUENCE ON KIDNEY AND LIVER ORGANS OF IODINE-131 CONTAMINATED WISTAR RATS (WITH AND WITHOUT THYROID)

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Abstract

Iodine-131 is considered one of the most frequently used radionuclides for diagnosis and radiotherapy of thyroid diseases. Its use in therapy has become a common practice especially with the increase in the frequency of thyroid cancer in the world. Although the thyroid is the target organ, iodine can transit and accumulate in other organs through the blood circulation in the body.

In this study we propose to evaluate the activity of iodine accumulated in kidney and liver organs at different periods (5, 24, 48 hours, 7 and 13 days after iodine orally administrated) for two Wistar rat models with and without thyroid. These activities have then been measured using gamma spectrometry technique and the respective

organ's doses have been calculated. The consequences of iodine irradiation on tissue as well as organ function have been examined using histological section and blood parameters measurement.

The results revealed for the kidney organ some disturbances, from inflammation to the presence of tissue fibrosis and glomerular necrosis, with disruption of certain parameters such as creatinine. For the liver organ, there is the appearance of inflammatory focus at different degrees around the door spaces accompanied by perturbations in the blood parameters.

O35: DEVELOPMENT OF CALIBRATION PROCEDURES OF AN ELECTRONIC PORTAL IMAGING DEVICES A-Si 1000 USED FOR IMRT AND VMAT

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Abstract

In recent years Electronic Portal Imaging Devices (EPIDs) have become an indispensable tool for the patient verification set-up in radiotherapy. Therefore, for their use in dosimetry, a calibration and an investigation into their physical characteristics is necessary. The aims of the present study is the development of calibration procedures and investigate the stability and the linearity of the signal of the portal imager a-Si 1000.

The measurements of the grey level pixels are carried out in the central axis of the beam. The EPID is calibrated by acquiring an image (DF) with no radiation and an image (FF) recorded with an open field irradiation. This calibration image, however requires a uniform FF image. To achieve uniformity, an optimum thickness of solid water buildup has to be found. The imager is calibrated with varing the thicknesses of a solid water builup placed on the detector surface. These calibrated images were compared to ionisation chamber recorded in water at *d*max. The measurements assume lineaire proportionality between EPID and the dose deposed in the central axis. The *portal imager a-Si1000* is characterized by good stability of the signal in a short time.

PT6: NUCLEAR REACTOR PHYSICS AND APPLICATIONS

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Abstract

Science is the base for all technology development of human life and Society. Physics is one of the most important branches of science concerned with nature, energy and material properties. While energy is the backbone of human development and civilization, particularly in the fields of industry, agriculture, urbanization, medicine and many others, science and physics offer the basic tools for energy technology development.

In this presentation, the link between physics and energy technology applications, in particular the nuclear energy, will be demonstrated.

Starting from different stages of theory that explains different natural phenomena (e.g. gravity and nuclear fission) to the development of mathematical laws described by different analytical mathematical formulas and finally to digital numerical equations that could be written in different computer software languages. These computer software programs (computer codes) are used for optimal design finding with different criteria (e.g. maximum power, safety, material properties, ..etc) of a particular application.

Peaceful nuclear energy is one of the most important energy forms. Its main advantage is its continuous productivity of energy with time, mainly in electricity form.

Nuclear reactors (whether for researches or power production) are the tools either to carry different researches and civil applications or (for power reactors) to transfer the nuclear energy from uranium fission energy to kinetic energy to thermal energy to Mechanical energy and at end to electrical energy.

Many Arab and Middle East (ME) countries, particularly those having large areas of desert as in North Africa and the Gulf regions, are facing energy challenging demand. Desert in these regions exceed 90% of total area in some countries. The main electrical network grids in these ME countries cover small areas (with high population). The desert areas need more practical and economical energy solutions.

Most current nuclear power plants in the world are designed for large size electricity production. The idea of Small and Medium size nuclear power plants, though an old idea, was not widely implemented.

A small power reactor (called ALEX-50) has been designed to produce 50 MW of electricity which may serve the needs of 200,000 families or less if part of energy is used for desalination, new agriculture lands and industry. One power unit of such type might cost less than 100m$ with quite competitive price for kwh production.

A 1 MWe reactor model to ALEX-50, had been designed and manufactured in Egypt (as part of a project at Alexandria University), proved the potential of national industry to share the manufacturing of larger components of ALEX-50.

O36: ISOTOPIC CHARACTERIZATION FOR NUCLEAR REACTIONS IN THE OKLO NATURAL REACTORS

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Abstract

The Oklo uranium ore in the Francevillian basin at the east part of the Republic of Gabon is known as a fossil of natural fission reactors, because large-scaled fission chain reactions spontaneously occurred in the ore two billion years ago. It is of major concern to characterize the properties of nuclear reactors and to investigate the behavior of fission products in and around the Oklo natural reactors. In this review, geological and physico-chemical characteristics of the Oklo natural fission reactor and its implication for radioactive waste disposal are shown.

The Oklo uranium deposit had partly functioned as natural fission reactors.Large-scale fission chain reactions spontaneously occurred at 16 separate areas in the Oklo deposit, so-called "reactor zones (hereafter, RZs)", two billion years ago, and sustained intermittently for 24000 to 300000 years.Since the main reactions in RZs are caused by ^{235}U fission, significant depletion of ^{235}U ($^{235}U/^{238}U<0.007252$) is observed in the RZs samples. The fission process for thermal neutron-induced ^{235}U fission produces fragments with a wide range of mass ($72<A<162$; A=mass number), and neutrons. As the results, many elements of the Oklo RZs and the related samples show the variations in the isotopic compositions caused by a combination of nuclear fission, neutron capture and radioactive decay.Isotopic measurements by mass spectrometry provide useful information of geochemical behavior of fissiogenic radioisotopes and neutronic characteristics of the reactors. Since the discovery of the first RZ in 1972, many isotopic studies have been performed to understand the mechanism of the operation as fission reactors and to trace the migration behaviors of fissiogenic isotopes produced in the reactors.

Elements compatible with U, such as rare earth elements (REE) have been relatively well retained in the reactors in spite of weathered conditions in and around the RZs. On the contrary there are some differences in the retention of non-compatible elements between weathered and non-weathered reactors. Besides the properties of fissiogenic nuclides, the differences in degree of retention of fissiogenic nuclides between RZs may depend upon the hydrologic, thermal, mechanical and physicochemical conditions of the RZ. The retentivities of radionuclides produced in a RZ vary in different locations even in the same RZ.

The estimation of nuclear parameters of reactors is required to elucidate the fission mechanism in the natural fission reactors. Some of REE isotopes such as^{143}Nd,^{149}Sm,^{155}Gd and^{176}Lu sensitively interact with fission-released neutrons because of their large neutron capture cross-sections. Nuclear parameters of analyzed samples can be quantitatively calculated by using isotopic deviations of such nuclides.In this talk, some typical examples of the isotopic data from the Oklo RZs, and explain the interpretation will be shown.

O37: GENERIC MODEL FOR NATURAL NUCLEAR REACTORS: FROM OKLO TO A POSSIBLE PRIOR GEOREACTOR

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Abstract

The Oklo phenomenon discovered in a 2 billion years old uranium deposit remains a scientific mystery for 45 years since its discovery. A complete understanding of this phenomenon needs to associate neutron physics with geological statements. The occurrence of criticality of the Oklo reaction zones has been explained in previous works (NAUDET 1991, BENTRIDI 2011) but the questioning about a possible occurrence of older nuclear fission reactor is still intriguing and the present work show some interesting results about such possibility of ancient georeactor presence on earth.

The Oklo natural nuclear reactors (located in Franceville basin, Gabon) present a real case of long-life operating nuclear system with thermal neutrons. Without any possible human intervention and considering their geological history, Oklo reactors were always considered as the natural analogue of geological storage of nuclear waste. Under thermal effects, altered surroundings of reactor cores evolved into a clay envelope of this high U-rich ore. The key to understand the operating of Oklo reactors undergo the understanding of thermal effects besides the neutron physics of such a system. The modern and recent processing of historical drills and outcrops of Oklo situation shed light on some unrevealed feature on the way how nature acted to ignite and maintain a sustained chain of fission reactions. Initially, MCNPX simulations permit us to explore and investigate related neutron physics of Oklo situation with real geological constraints and limits. Later, with developed shell scripts dedicated to natural U-rich configurations it became possible to interact with Monte-Carlo simulations and optimize time and calculation power to define all possible critical configurations, even for different geological ages. We extrapolate then, from Oklo case to a generic model covering any possible natural nuclear fission reactors occurrence. Very small dimensions cylinder (about few centimeters radius by few tens centimeters length) could be obtained as possible critical configurations for an older age before 2.0 b.y. Here, nature made it in easier way with long life systems including waste management with fuel confinement in space and time. Probably, prior natural nuclear reactors to Oklo have been occurred in an ancient past but their confirmation needs more investigation and new way to observe their signatures, unlike the Oklo case which presents a physical presence with several observations, measurements and analysis

O38: MODERN POINT OF VIEW ON OKLO

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Abstract

The Oklo phenomenon discovered in a 2 billion years old uranium deposit remains a scientific mystery for 45 years since its discovery. A complete understanding of this phenomenon needs to associate neutron physics with geological statements. The occurrence of criticality of the Oklo reaction zones has been explained in previous works (NAUDET 1991, BENTRIDI 2011) but the questioning about how did those systems operate and evolve in their geological environment. Scientific studies were carried out by means of bore holes, geological cuts and

outcrops made during the exploitation of the Oklo andOkelobondo mining sites. These sites are now drowned as are the neighboring sites of Mounana and Mikouloungou. In the site of Bangombé a reactor was identified in sub-surface. It is preserved for the collective memory after having been studied by a set of boreholes. We have recently compiled the historical geological information from Oklo using the GDM software from the BRGM. On the basis of 3D reconstruction of reaction zones 2 to 6, we were able to extract 2D projections and maps which revealed the characteristics of couplings of certain cores. The second part of the presentation will begin with the presentation of these unique data. Their precise analysis in terms of coupling and dynamics of the cores will then be discussed before concluding on a model of evolution of the cores running from the start of the first small cores to the advent of big cores such as the reactor 2 which mobilized several hundred tons of uranium.

O39: A SIMPLIFIED NUCLEAR THERMALHYDRAULIC CHANNEL MODEL FOR NUCLEAR RESEARCH REACTORS USING PLATE TYPE FUEL

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Abstract

The thermalhydraulic nuclear reactor core channel analysis is done thanks to the conservation equations of mass, momentum and energy, for an incompressible fluid. The conservation equation of momentum is solved upwards in the channel in order to obtain the velocity in the channel using Runge Kutta method of order 4 without the pressure term, knowing the inlet velocity which is taken as initial velocity. At the same time the differential pressure equation is solved downwards in the channel, by Euler method, using the outputs of the preceding calculation and using the output pressure as the initial value. When the entire values of velocity and pressure vectors are obtained, a loop calculation is carried out using the ascending Euler method for velocity and then descending for pressure until convergence. The power generated in the channel is evaluated using the indicated power of the installation weighted by a conversion efficiency factor and a factor giving the ratio of the flow in the channel and the total flow in the nuclear reactor core. The physical thermal quantities are then evaluated. The main results obtained deal with the evolution of the cooling fluid velocity and the static pressure along the thermalhydraulic channel as well as the evolution of the cooling fluid temperature and the temperature of the clad along this same channel. This approach is applied for a 02 MW nuclear research reactor using plate type fuel. The temperature profile of the coolant and the clad along the nuclear reactor core channel are plotted. For an upward flow, the obtained results were compared to those given by Boudali and Salhi, to those given by the code TERMIC and to those obtained by Labani et al.. The obtained results are very close to those obtained by the cited authors and the calculated relative differences are minor.

O40: NEUTRON DIFFRACTION ANALYSIS OF $BATI_{1-X}MG_{X/3}NB_{2X/3}O_3$ (X = 0.03) COMPOSITION

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Abstract

In comparison with X-ray diffraction, Neutron powder diffraction, owing to its relatively higher scattering cross section for oxygen, is particularly useful in the detection of weak and high angle peaks in perovskite-type oxides, thus provide more accurate lattice parameters and allow for a more precise detection of any symmetry changes. Therefore, in this work Neutron diffraction data were used to study the structural features of the material $Ba(Ti_{(1-x)}Mg_{x/3}Nb_{2x/3})O_3$ with x=0.03.

Neutron powder diffraction data were collected at three temperatures T=300K, 260K and 200 K using the PITSI diffractometer at the Safari 1 Research Reactor (NECSA, South Africa). The 2θranges covered were 10–

115° in 0.05552° steps, and with λ=1:08 Å. *Rietveld* refinement full profile fitting was done using the program FULLPROF (Rodriguez-Carvajal 1995).The following neutron scattering factors were used b_{Ba} = 5,071 fm, b_{Ti} = -3.438 fm, b_{Mg} =5.375 fm, b_{Nb} =7.054 fm and b_O =5.803 fm. The background was linearly interpolated between given points, taken from each profile, while the peak shapes were modeled using a pseudo-Voigt profile shape function. The evolution of structural parameters with temperature has been discussed.

O41: DETERMINATION OF RARE EARTH ELEMENT REE IN GEOLOGICAL MATERIAL BY NEUTRON ACTIVATION ANALYSIS INAA AND K_0-NAA

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Abstract

The mobilization of rare earth elements (REEs) in the environment requires monitoring of these elements in environmental matrices, in which they are mainly present at trace levels. The similarity in (REEs) chemical behavior makes the separate determination of each element by chemical method difficult; instrumental neutron activation analysis INAA and k_0-NAA, based on nuclear properties of these elements to be determined , is a method of choice in trace analysis of REEs and related elements. NAA was applied as a sensitive nondestructive analytical tool for the determination of RRE to find out what information could be obtained about the REE of Algerian red rock collected from Azzazgua in Tizi-ouzzou, north centre of Algeria.

The samples were properly prepared together with standards and flux monitors are simultaneously irradiated in a neutron flux of 4.77 10^{12} n/cm^{2}s at Es-Salam Resaerch reactor. The following elements have been determined : Ce, Eu, La, Lu, Nd, Sc, Sm, Tb et Yb. The gamma spectra were collected by HP-Ge detector operated with Genie 2k software and the deconvolution was done by means of HyperLab program. To evaluate the accurate of the results the CRM-GSD12 (sediment) and NIST -1646a was executed. The analytical results showed that the relative error of most of the elements was less than 10%.

O42: TRIAXIAL ROTOR MODEL WITH RIGID MOMENTS OF INERTIA

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Abstract

An alternative to the hydrodynamical triaxial rotor of Davydov and Filippov is investigated. In this approach I have adopted the nuclear moments of inertia resulting from the rigid nucleus approximation. The model is tested by comparing its predictions to the experimental data.

The triaxial rotor model has been introduced by Davydov and Filippov in 1958 as an analytic solution to Bohr Hamiltonian. The authors adopted an irrotational flow assumption to express the moments of inertia. The resulting model shows a symmetry about γ=30° and a singular behavior for γ=0° and γ=60°.

In the present work the dependence upon the deformation (β, γ) parameters is relaxed by adopting rigid moments of inertia. New expressions for the energy levels and transition probabilities are formulated.

In order to test the model two sets of the deformation parameters values are extracted using the energies and the decay properties, respectively. Subsequently, they are used to calculate the spectra and the transition probabilities of well deformed nuclei, mainly in the rare-earths region. The relevance of the model is then discussed.

O43: ENERGY ABSORPTION BUILDUP FACTORS AND EXPOSURE BUILDUP FACTORS VARIATIONS WITH DEPTH FOR BIOLOGICAL MATRICES IN PHOTON ENERGIES 0.05 TO 3 MEV

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Abstract

Radiation dose received by human biological matrices and the distribution of photon flux inside the body in any medical imaging or radiation therapy is affected by various parameters such as mass attenuation coefficients, equivalent atomic number and build up factors. Energy absorption (EABF) and exposure buildup factors (EBF) have been estimated for some biological matrices including nine different tissues in the energy region 0.05–3 MeV up to a penetration depth of 40 mfp (mean free path). Geometric progression (G-P) fitting approximation has been used to calculate EABF and EBF of adipose, skin, muscle, brain, blood, lung, soft, compact bone, and cortical bone tissues. It has been observed that the examined biological matrices show variations in their EABF and EBF with incident photon energy, penetration depth and equivalent atomic number with a significant difference in the intermediate region where Compton scattering dominates. The obtained buildup factor can be useful in estimation the biological effects of radiation doses.

POSTER SESSIONS

TOPIC 1: RADIATION-NUCLEUS INTERACTION

P001: NUMBER-PROJECTED NEUTRON-SYSTEM RADII OF ODD-MASS N≈Z NUCLEI IN THE ISOVECTOR PAIRING CASE

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Abstract

The neutron-system radii (rn) of odd-mass N≈Z nuclei are studied by including the neutron-proton (np) isovector pairing correlations within the Sharp-BCS (SBCS) number-projection method. As a first step, expressions of the quadratic neutron-system radii for odd-mass systems are established within BCS and SBCS approaches. As a second step, the np pairing and projection effects on rn are numerically studied for odd-mass N≈Z nuclei using the single-particle energies of a deformed Woods-Saxon mean-field.

The study of nuclei far from the valley of stability is one of the active fields in nuclear physics on both theoretical and experimental sides. Among others, nuclei close to the proton dripline (i.e. such as N≈Z) are intensely studied. In this kind of nuclei, neutron-proton (np) pairing correlations must be taken into account. The latter are often studied within the BCS theory. However, due to the particle-number fluctuations that are inherent to this theory, a rigorous study of these correlations requires a particle-number projection. On the other hand, the study of the neutron-system radii (rn) can contribute to the understanding of the structure of these nuclei. Such a study has been recently performed for even-even nuclei [1] using the Sharp-BCS (SBCS) projection method [2]. In the present work, this study is extended to odd-mass systems, using a recently proposed projected wave-function [3]. As a first step, expressions of the quadratic neutron-system radii for odd-mass systems are established within BCS and SBCS approaches [4]. As a second step, the isovector np pairing and projection effects on rn are numerically studied for odd-mass N≈Z nuclei using the single-particle energies of a deformed Woods-Saxon mean-field.

It is shown that the np pairing effect is not very important and of the order of 1%. It is noticed that, before projection, it decreases as a function of (N–Z). After projection, it seems to not actually depend on (N–Z). In addition, there is a clear difference between odd-Z and even-Z nuclei.

Moreover, it appears that the projection effect is practically the same in the like-particles case and in the isovector pairing one. It is however somewhat small and does not exceed 1.5% on average. There is also a clear odd-even effect.

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P002: EFFECTIVE CHARGE PARAMETER FOR LI AND O IONS IN ALUMINUM, SILVER, GOLD, POLYPROPYLENE AND MAKROFOL FOILS

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Abstract

In the present work we were interested in determining the effective charge parameter of Lithium and oxygen ions in the energy range 0.4 MeV/u - 4 MeV/u, through Aluminum, Silver, Gold, Polypropylene and Makrofol films. The effective charge of Li and O ions are calculated using the experimental data of stopping power taken from Helmut Paul [1].

We have compared the data of the effective charge with different data using the stopping power tables ICRU 49+73, MSTAR, CASP 5.2 and also the effective charge theory of Brandt and Kitagawa[2].

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P003: DOSE MEASUREMENTS IN HETEROGENEOUS MEDIUM FOR HIGH ENERGY PHOTON BEAMS

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Abstract

In radiotherapy the determination of the dose at a specific point is a very important challenge for the medical physicist especially in a complex medium with different densities. The aim of our work was to find a measurement procedure to reach the delivered dose at a specific depth, for that we used phantoms with two densities that we made with two materials, and for the measurements we used diodes and ionization chamber as a reference detector. The experimental work has been realized with a linear accelerator with two photon energies in Blida radiotherapy service (C.A.C Blida). At the other hand, we used a treatment planification system for the result analysis; we compared the measurements data and the prediction of the calculation. We obtained good results that we provide us the ability to go after with other kind of phantoms (i.e. a rib cage) and body movement.

P004: IMPLICATION OF THE POLARIZATION FORCE ON THE SELF-SIMILAR EXPANSION OF A DUSTY PLASMA INTO VACUUM

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Abstract

The effects ofthe polarization force on the self-similar expansion into vacuum of an unmagnetized, collisionless dusty plasma are addressed. It is found that the polarization force may drastically influence the general trends of

the self-similar expansion. It is noticed that when the polarization force dominates over the electrical one, the self-similar expansion of the dusty plasma cannot set in because the net force experienced by the dust grains is not a restoring force. Dust wave breaking and inherent dust bunching then occur preventing therefore the expansion of the dust grains. For any value of the polarization parameter R ranging from zero to a critical valueR_{cr}, the sound-speed increases as the dust number density increases. As R increases, the values of the plasma soundspeed are shifted towards higher values before decreasing beyond the critical value R_{cr}. As R increases from zero to Rc, the plasma expansion becomes faster compared to those of the other cases, and large velocities are communicated to the dust grains. This is attributed to the fact that as R increases from 0 to R_{cr}, the electrostatic potential and thus the electric field are sustained over a larger distance allowing therefore the dust particles to expand over a much farther distance.

P005: NEW DETERMINATION OF ASTROPHYSICAL REACTION RATE OF $^{12}C(\alpha,\Gamma)^{16}O$ AT THE RADIUS R=7.7 FM

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Abstract

The reaction $^{12}C(\alpha, \gamma)^{16}O$ was investigated through the direct α-transfer reaction (^{7}Li,t)at 28 and 34 MeV incident energies. We determined the reduced α-widths of the subthreshold2^{+} and 1^{-}states of ^{16}O from the DWBA analysis of the transfer reaction$^{12}C(^{7}Li,t)^{16}O$ performed at two incident energies and at the radius r=6.5 and 7.7 fm. The obtained result for the 2^{+} and 1^{-}sub-threshold resonances as introduced in the R-matrix fitting of radiative capture andelastic-scattering data to determine the E2 and E1 S-factor from 0.01MeV to 4.2MeVin the center-of-mass energy. After determining the astrophysic factor of $^{12}C(\alpha, \gamma)^{16}O$S(E) with Pierre Descouvement code, I determined numerically the reaction rateof this reaction at r=6.5 fm and at a different stellar temperature (0.06 Gk-2 GK). For The $^{12}C(\alpha, \gamma)^{16}O$reaction rate at T_9 = 0.2 is $[7.21+2.15-2.25] \times 10^{-15}$ cm^3 s^{-1} mol^{-1}. I will also determined a new reaction rateof this reaction at r=7.7 fm.

P006: NEUTRON-PROTON PAIRING AND PARTICLE- NUMBER FLUCTUATION EFFECTS ON THE MOMENT OF INERTIA OF EVEN-EVEN PROTON RICH NUCLEI.

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Abstract

Isovector neutron-proton (np) pairing and particle-number fluctuation effects on the moment of inertia of even-even proton-rich nuclei are studied. As a first step, an expression of the particle-number projected nuclear moment of inertia is established within the crankingmodel.It is shown that it generalizes the one obtained in the like-particles pairing case. As a second step, the moment of inertia values of deformed even–even nuclei such as (N−Z)=0,2,4 are calculated using the single-particle energies and eigen-states of a deformed Woods-Saxon mean-field. It is shown that the np pairing effect is important and clearly depends on (N–Z). Moreover, the particle-number fluctuations effect is very important and practically independent of (N–Z).

P007: EXACT SOLITONS SOLUTIONS OF THE CUBIC-QUINTIC NONLINEAR SCHRÖDINGER EQUATION IN FIBER BRAGG GRATINGS

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Abstract

The periodic structure in a fiber known as fiber Bragg grating, is important components in fiber communication as add/drop multiplexers, dispersion compensator, narrow band reflector, and sensing fields [1]. A notable feature of this periodicity is the presence of photonic band gap (PBG) and results in strong reflectivity near the Bragg wave length. This stop gap offers the possibility of observing a variety of nonlinear dynamical effects such as formation of grating soliton popularly known as gap solitons. Similar to optical fiber, they are formed by the balance between the nonlinearity and the group velocity dispersion [2]

In this work we investigate theoretically the existence of solitons in fiber Bragg grating, in which nonlinearity contains both cubic and quintic effects. By using multiple scale analysis we reduce the nonlinear coupled mode (NLCM) equation, which describing propagation of femtosecond light pulses through the fiber Bragg grating, into the perturbed nonlinear Schrödinger (PNLS) equation. Adopting the anstz of Li and al [3], we find bright and dark solitary wave solutions.Furthermore, we arealso calculatedtheirimportantphysical parameters such aspower and pulse width.

Keywords: *fiber Bragg grating, gap solitons, nonlinearity.*

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P008: TEMPERATURE EFFECT ON THE ISOVECTOR PLUS ISOSCALAR NEUTRON-PROTON PAIRING CORRELATIONS USING A PATH INTEGRAL APPROACH

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Abstract

Explicit gap equations in the isovector plus isoscalar (T = 0 + T = 1)neutron-proton (n-p) pairing case at finite temperature are established usingthe path integral approach.It is shown that they do generalize theones obtained in the pure isovector (T = 1) pairing case, as well as thoseobtained within the conventional finite temperature BCS (FTBCS) theoryin the pairing between like-particlescase.A numerical study is then performed using the schematic one-level model.

Due to fast progress in Radioactive Ion Beam programs, the study of neutron-proton (n-p) pairing effects has known a renewal of interest during the last decade (cf. e.g. [1-3]). 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. N-p pairing effects may exist in two varieties: the isovector (T=1) and the isoscalar (T=0) pairing, where T is the isospin quantum number. On the other hand, the study of the temperature effect on pairing correlations at finite temperature have been the subject of many efforts sincethe sixties and is still a relevant subject[3- 5].

In the present work, temperature effect on the isovector plus isoscalar n-p pairing gap parameters is studied. With this aim, explicit gap equations are established using the path integral approach. It is shown that they do

generalize the ones established in the isovector pairing case [3]. The model is numerically applied within the schematic one-level model.

It is shown that the isoscalar n-p gap parameter $\Delta_{np}^{T=0}$ behaves, as a function of the temperature, like its homologues Δ_{pp} and Δ_{nn} in the conventional FTBCS approach. As for the three other gap parameters, i.e. $\Delta_{np}^{T=1}$, Δ_{pp} and Δ_{nn} their behaviors are clearly modified when the isoscalar pairing is taken into account. In particular, one observes a shift of the values of the critical temperatures.

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P009: DISPERSION CANCELLATION USING LINEARLY CHIRPED BRAGG GRATING FILTERS IN OPTICAL WAVEGUIDES

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Abstract

FIBER BRAGG gratings are proving to be one of the most important recent developments in the field of optical fiber technology. It can be fabricated by exposing the core of the optical fiber to UV radiation. They basically constitute generalized distributed reflectors whose reflection spectra and dispersion characteristics are wavelength-dependent and can be accurately adjusted by proper design. They can be effectively used for dispersion compensation in high-bit-rate, long-haul fiber communication links [1]–[7] and short-pulse generation and restoration [8], [9]. On the other hand, fiber Bragg gratings can be used for the implementation of high-quality fiber laser cavities of various geometries [10], [11] and semiconductor diode stabilization [12], [13].

In this work, we are interested in the study and optimization of spectral responses of linearly chirped FBG. We present a numerical analysis of some LCFBG in accordance with their physical parameters for reflectivity, time delay and dispersion. The relationship between a bandwidth's change and average group delay ripple's variation after apodization. Preliminary results show that LCFBG length and the refractive is key parameters for optimizing the spectral performance of different Bragg gratings. Reflection spectra, group delay and dispersion of these gratings were analyzed using different optimized physical parameters. Our numerical analysis is based on Matlab code.

Keywords: *Optical Fiber, Fiber Grating, Apodization Function, Coupled Mode Theory, Chirped Fiber Bragg Grating, Time Delay, Dispersion.*

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P010: APPLICATIONS IN THE EXTENDED THEORY

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Abstract

Recent cosmological data show that the universe is expanding at an accelerating rate. This contradicts the results of general relativity, at least for a Universe composed only of matter. To attack this problem, two general ways have been taken: introducing a new type of energy (such as the cosmological constant Λ , dark energy) or modifying the theory of gravitation.So, several extensions to the theory of gravitation were proposed in order to preserve the positive results of Einstein’s Theory of general relativity. The simplest extension is the so called $f(R)$ gravity which consists in replacing the Ricci scalar R by a function f of it.Here, we review $f(R)$ gravity, a modification to general relativity, are all about modifying the Einstein-Hilbert action and taking it to higher orders in the Ricci scalar. In this work we will be essentially interested in examining how does $f(R)$ gravity affects the behavior of a charged compact star.We study the effect of electric charge in compact stars assuming that the charge distribution is proportional to the mass density. We perform a detailed numerical study of the effect of electric charge using a polytropic equation of state. We first try to find the numerical results given in a paper of S. Ray et al. and then apply $f(R)$ gravity to study the effect of the correction terms given.

P011: DICLUSTERING IN ACTINIDE NUCLEI

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Abstract

The cluster model aims to describe the nucleus as a few body system consisting of a number of clusters and eventually a core. In this communication, we treat even even heavy nuclei as three body systems (a core and two clusters of alpha particles) through an extension of the nuclear vibron model of Iachello and Daley. The relative motion of the clusters is given by the algebraic structures U(4) x U(4). The internal structure of the core is taken into account by U(6) , the symmetry algebra of the interacting boson model while the clusters of alpha particles are assumed to be structureless. Then the appropriate algebraic structures of the model is U(6) x U(4) x U(4). We show that, there are two dynamical symmetries describing the harmonic motion of the clusters in an axially deformed nucleus. The model is applied to some actinide nuclei and a comparison of the obtained results to experimental data is given.

P012: JET MASS DISTRIBUTION WITH K_T CLUSTERING

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Abstract

Event shape observables are considered as an excellent tool for testing and demonstrating the validity of QCD. They are being used to study the jet substructure which refers to the internal characteristics of the jets themselves. This latter is studied for example in the aim to make differences between boosted objects and QCD backgrounds at the LHC and Tevatron. Thus jet substructure will play an important role in both Standard Model and BSM searches. In this communication we treat, the phenomenologically most important jet shapes, the jet mass. The distribution of the mass of a high-*pt* QCD jet is studied using analytical calculations. The latter suffersfrom large logarithms in the distribution which appear because of the non-global nature of this observableand which are absent for global observables.In the presence of jet algorithm, there is also the issue of clustering logarithms that were noticed tofirst appear at $O(\alpha_s^2)$.

P013: STUDY OF THE LATERAL SPREAD OF IONS THROUGH MATTER

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Abstract

In this contribution, lateral distributions of MeVtransmitted ions through different solid targets are calculated using the model of Marwick and Sigmund (MS). The effect of energy loss is directly included in this model. Another method is proposed in this work by using the Sigmund and Winterbon model (SW) of multiple scattering to calculate the angular distributions. The corresponding lateral distributions are deduced using the scaled law of Marwick and Sigmund. The incorporation of energy loss in this case is done with the model of Valdés.

We consider a beam of mono-energetic charged particles transmitted through an amorphous foil of thickness x. The angular distribution $F(x,\theta)$ and lateral spread $G(x,\rho)$ of transmitted particles are given respectively by:

$$F(x,\alpha)\,d\Omega = \frac{d\Omega}{2\pi}\int_0^\infty k\,dk\,J_0(k\alpha)\exp\left[-N\,x\,\sigma_0(k,E_0)\right] \quad (1)$$

And

$$G(x,\rho)d^2\rho = \frac{\rho}{x}d\left(\frac{\rho}{x}\right)\int_0^{\infty} k\,dk\,J_0\left(k\frac{\rho}{x}\right)\exp\left[-N\,x\frac{1}{k}\int_0^{k}dk'\,\sigma_0(k',E_0)\right] \quad (2)$$

Where α is the total deflection angle, ρ is the lateral spread, $d\Omega$ is the solid angle, N is the number of scattering centers per unit volume and $J_0(z)$ is the zero-order Bessel function of the first kind. $\sigma_0(k,E_0)$ is the transport cross section.

The obtained lateral distributions are compared to experimental results. This comparison shows that the proposed calculation give a better agreement with the experimental results.

P014: MEASUREMENT OF NUCLEAR Γ-RAY LINE CROSS SECTIONS IN PROTON OFF 56FE TARGET OVER INCIDENT ENERGIE RANGE E= (66-125) MEV

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Abstract

γ-ray production cross sections have been measured in proton irradiations of a 6 g. cm^{-2} ^{56}Fe target at the separate-sector cyclotron of iThemba LABS, Cape Town (South Africa). A high energy-resolution detection system composed of 8 clovers, each containing 4 HPGe crystals with associated BGO Compton suppression, were used to collect γ-ray spectra at 5 proton bombarding energies of 66, 80, 95, 110 and 125 MeV. The detectors were placed at angles of 90° and 135° relative to the incident proton beam direction around the AFRODITE reaction chamber. In this contribution, a special attention has been paid to the γ-ray lines at E_γ=1238 keV and 1408 keV from the ^{56}Fe(p,xγ) reaction for which differential cross section data are reported for the first time over the investigated proton energy range. The measured nuclear data and calculated γ-ray spectra can be pertinently used for determining the properties of various astrophysical sites contain large fluxes of high energy protons and abundant ^{56}Fe target nuclei, like the ISM. The comparison of the present experimental data to lower proton energy data available in the literature shows mostly good to excellent agreements.

Keywords : *High energy proton beam; Abundant Fe target nuclei; Complexγ-ray spectra; Solar flares, ISM.*

P015: ANALYSIS OF MAXWELLIAN AVERAGED CAPTURE CROSS SECTIONS USING EVALUATED NUCLEAR REACTION DATA LIBRARIES

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Abstract

We Compare the Maxwellian-averaged cross sections (MACS) of the stellar nucleosynthesis reactions (n,gamma) using the ENDF/B-VII.1, KADONiS, EXFOR and JEFF-3.1 evaluated nuclear data libraries. The capture cross sections were compared first with the change of database where the nuclear reaction libraries were processed under the same conditions for Maxwellian temperatures (kT) for two cases 30 kev and 1420 kev for different elements and in the second way between two database one in 30 kev and the other in 1420 kev for different elements and finally with the same database library and for different Maxwellian temperatures (kT) for different elements, we find that there aren't a big differences between libraries and rare cases like ^{26}Mg and ^{208}Pb when KT increases The Maxwellian-averaged capture cross sections increases also for a KT value interval, have influence with those elements as neutron poison.

P016: THEORETICAL STUDY OF ALPHA DECAY BASED ON WOODS-SAXON POTENTIAL

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Abstract

The purpose of this work is the investigation of the alpha decay properties of superheavy nuclei within the Unified Fission Model based on a Modified Wood-Saxon potential taken as a proximity potential. In a first step, the predictive power of the model was confirmed in the region of heavy and super-heavy nuclei using different mass tables: Duflo-Zucker, Finite range droplet model, KUTY, and Wang tables. The present model was subsequently applied in Z = 120 – 130 region. The computed alpha decay half-lives are compared, on the one hand, with those obtained by Santhosh in the framework of the Coulomb and proximity potential model and, on the other hand, with the spontaneous fissionhalf-lives.

P017: STUDY OF THE ANGULAR AND ENERGY DISTRIBUTION OF EMITTED PARTICLES IN A NEUTRONS INDUCED NUCLEAR REACTIONS

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Abstract

In this work, the nucleons induced nuclear reactions have been studied in the low and intermediate energy by using the Multi-step Direct (MSD) and the Multi-step compound (MSC) processes. A significant contribution to the nuclear reactions cross sections of MSC for low energy and significant contribution of MSD for intermediate energy were obtained.

Based on the Kalbach formalism, we have studied the double differential cross section $\frac{d\sigma}{dEd\Omega}$ of the following reactions:

$^{149}_{62}Sm$ (n,α)$^{146}_{60}Nd$ and$^{143}_{60}Nd$ (n,α)$^{139}_{58}Ce$.

Keywords : *nuclear reactions cross sections, Multi-step Direct (MSD), Kalbach formalism, double differential cross section*

P018: SYSTEMATIC STUDIES OF CN CROSS SECTIONS WITH THE OPTICAL MODEL : APPLICATIONS TO THE (N, P) EXCITATION FUNCTION REACTIONS

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Abstract

By using the optical model, systematic studies of CN cross sections were carried out and analytical expressions have been deduced for calculating the neutron, proton and alpha reaction cross sections. The new 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≤A≤ 100. The choice of optical model parameters is based on the reproduction of experimental differential cross section data of the elastic scattering at angles 0°≤□≤180°. The systematic behavior of the optical model results was studied before choosing the pertinent dependence on the energy and the mass number, and setting up the reaction cross sections formulae.

The analytical expressions, of the reaction cross sections for neutrons and alpha, were used within the evaporation statistical model to calculate the excitation functions of (n,p) reactions in the same energy range as reaction cross sections. The description of the (n,p) cross sections by these systematic studies has been compared to experimental data available in the nuclear data library EXFOR. The results of the (n,p) excitation function shows a good agreement with recent experimental data.

Keywords:*Cross section, CN reaction, optical model, (n,p) reaction fast neutrons.*

P019: INTEGRATED PROTON AND DEUTERON ACTIVATION ON ALUMINIUM

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Abstract

In this work, we present preliminary results associated to the irradiation of thick sample of aluminium, using proton and deuteron beams delivered by the Tandem accelerator of IPN Orsay, at three energies ranging from 15 MeV to 22.8 MeV and at beam intensities of a few nA.

Isotopic production yields were determined for several (p,x) and (d,x) reactions on aluminium, using a high-purity co-axial germanium detector. They are compared to earlier experimental works.

In addition, integrated activation cross-sections are extracted and compared to TALYS 1.6 calculations and to values derived from thin-target measurements reported in the literature.

P020: EXTENDED THOMAS-FERMI DENSITY FUNCTIONAL IN THE PRESENCE OF A TENSOR INTERACTION IN AXIAL SYMMETRY

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Abstract

In nuclear structure physics the term tensor in the two-nucleon nucleon effective interaction has been known for a long time, this part of the nucleon-nucleon force has been generally neglected in the average field type calculation. Very recently, this tensor term was included in the Skyrme-Hartree-Fock model with a tensor term in

the interaction. In this work we have studied the additional terms which appear in axial symmetry generated by the tensor part of the interaction using the semi-classical method. By calculating and studying the spin currents generated at the presence of the tensor force and then the application on some atomic nuclei.

Depending on the system of linear equations calculated in the article[1] we could find the analytical expressions of spin orbit densities J_n (of neutrons) and J_p (of protons) written functions of the local densities ρ_n, ρ_p and its derivatives, the effect mass and skyrme's constants. f_n f_p

Or

$$J_n = \frac{1}{\det(A)}\left(\frac{\eta^2}{2m}\left(C_0^{\nabla J} + C_1^{\nabla J}\right)\rho_n f_p + 2\left(C_1^{\nabla J} C_0^{J} + C_0^{\nabla J} C_1^{J}\right)\rho_n\rho_p\right)\nabla\rho_n + \quad (1)$$

$$\left[\left(\frac{\eta^2}{2m}\left(C_0^{\nabla J} + C_1^{\nabla J}\right)\rho_p f_n + 2\left(C_1^{\nabla J} C_0^{J} + C_0^{\nabla J} C_1^{J}\right)\rho_n\rho_p\right)\nabla\rho_p\right] \quad (2)$$

With $$\det(A) = \left(\frac{\eta^2}{2m}\right)^2 f_n f_p + \left(\frac{\eta^2}{2m}\right)(C_0^J + C_1^J)(\rho_p f_n + \rho_n f_p) + 4C_0^J C_1^J \rho_p \rho_n$$

On which we have concluded the spin orbit potential where the nuclear energy written according to the latter, to finally find the nuclear energy of some atomics nucleus by programming all the data previously on a Fortran's language.

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P021: COUPLED CHANNELS OPTICAL POTENTIAL ANALYSIS OF ELASTICALLY SCATTERED NUCLEONS OFF MAGNESIUM ISOTOPES FROM 1 MEV UP TO 150 MEV

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Abstract

Optical model calculations have been performed on Mg for nucleon incident energies in the range, E = (1-150) MeV. The calculations have been made in the framework of the Soft Rotator Model and the Coupled-Channels approach using the OPTMAN code. The parameters used for the soft rotator Hamiltonian provided by Soukhovitsky et al. in the RIPL-3 data base were used with consideringrelativistic kinematics. The Optical Model parameters were extracted using experimental angular distributions for nucleon scattering off Mg available in the EXFOR data base and good agreement with experiment was achieved. Our model reproduces elastic scattering data better than the Global Optical Potential provided by Koning and Delaroche.

Keywords: Magnesium, Optical Model, Elastic scattering, OPTMAN code, Soft Rotator Model, Coupled-Channels.

P022: MEASUREMENTS OF ACTIVATION CROSS SECTION FOR ^{198}PT(N, 2N)^{197M}PTREACTION INDUCED BY NEUTRONS FROM 14.7 MEV

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Abstract

The cross section for the ^{198}Pt (n, 2n) ^{197m}Pt reaction has been measured in the neutron energy around 14.7±0.3 MeV using the activation technique (NAA). The Iron foils were used as neutron flux monitor via the ^{56}Fe (n,p) ^{56}Mn reference reaction. The fast neutrons were produced via the ^{3}H(d, n) ^{4}He reaction on Neutron Generator at the Research Centre Nuclear Algiers. The neutron fluences were determined by the cross section of ^{27}Al (n,p)^{27}Mg reaction.The cross section were discussed and compared with experimental data found in the literature, and with the comprehensive evaluation data in ENDF/B-VII, JENDL-3.3, and JEFF-3.1/A libraries.

Keywords: *Cross section, Activation technique, Fast neutrons. Neutron fluences, ENDF/B-VII, JENDL-3.3 and JEFF-3.1/A libraries.*

P023: CROSS SECTIONS OF NEUTRON REACTIONS (N,P) AND (N,2N) ON ISOTOPES SM,DY AND HO AT 14.5 MEV NEUTRON ENERGY

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Abstract

The cross sections of the nuclear reactions induced by neutrons at 14.5 MeV on the isotopes Sm, Dy and Ho are studied by the use of the experimental data and different theoretical approaches.

The experimental and evaluated data from EXFOR, TENDL, ENDF libraries are compared with different systematics and calculations by code of EM-PIRE 3.0. Contribution of pre-equilibrium decay is discussed. Different systematic for estimations of the cross-sections of considered nuclear reactions are tested.

Keywords: *Cross sections, EXFOR, TENDL, ENDF libraries, EM-PIRE 3.0, pre-equilibrium decay*

P024: MODELING HALO NUCLEI

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Abstract

In this article, we discuss how modeling halo nuclei considering both structure and break up reactions. We consider the halo phenomenon starting from the very beginning of its discovery until nowadays progresses. Information from literature are collected and selected. The main purpose of the paper is to write a useful excursus on halo nuclei studies from the first Tanihata's experiments to the contemporary works with a special emphasis on Borromean nuclei.

P025: THE RESPONSE OF MAGIC GEL TO EXTERNAL BEAM RADIATION

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Abstract

Polymer gels are relative chemical dosimeters. They allow to access to three-dimensional dose distribution. The aim of this study has been to investigate the preparation and the use of a polymer gel with a tissue equivalent density known as MAGIC gel from magnetic resonance imaging and x-ray computed tomography. This kind of gel is “normoxic” because it can be manufactured and used in normal room atmosphere. In the first part of this study, its accuracy and sensibility were studied using external beam irradiation by linear accelerator.

The response of the gels was revealed by relaxation rate measure (R_2) and Hounsfield units (HU). We got straight responses.

P026: NEUTRON-PROTON PAIRING AND PARTICLE-NUMBER PROJECTION EFFECTS ON THE SPECTROSCOPIC FACTOR FOR TWO-NEUTRON STRIPPING REACTIONS IN EVEN-EVEN PROTON-RICH NUCLEI

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Abstract

Isovector neutron-proton (np) pairing effect, as well as that of the particle-number projection, on the spectroscopic factor (SF) for two-neutron stripping reactions in even-even proton-rich nuclei are studied. As a first step, an expression of the spectroscopic factor is derived using a schematic definition of the SF proposed by Chasman and the Sharp-BCS (SBCS) projected wave-function. As a second step, the np pairing and projection effects are numerically studied using the schematic picked-fence model. As a last step, the same effects are numerically studied in the case of proton-rich nuclei using the single-particle energies of a Woods-Saxon deformed mean-field.

First studies of the neutron-proton (np) pairing correlations were performed in early sixties. However, as this kind of pairing is negligible in ordinary nuclei, it was not any more studied during a long time. It is only during the last two decades, with the advent of radio-active ion beams which made possible the experimental study of intermediate mass proton-rich nuclei, that the np pairing study knew a revival of interest. Indeed, in N≈Z nuclei, np pairing effect can not be neglected [1]. The latter is often taken into account within the BCS theory. However, it is well known that the BCS wave-function does not conserve the particle-number. A possible way to overcome this shortcoming is to perform a particle-number projection.

The goal of the present work is to study the isovector np pairing effect, as well as the particle-number projection one, on the spectroscopic factor for two-neutron stripping reactions in even-even proton-rich nuclei (i.e. such as (N–Z)=0,2).

As a first step, an expression of the spectroscopic factor, based on the schematic definition proposed by Chasman [2], is derived within the Sharp-BCS (SBCS) particle-number projection method [3]. As a second step, a numerical study of the np pairing and projection effects is performed using the schematic picket-fence model [4]. By comparing the results obtained within the SBCS method in the isovector pairing case and in the like-particle pairing one, and by comparing the results obtained before and after projection for each kind of pairing, it is shown that np pairing and projection effects strongly depend on the value of the pairing gap parameter of the initial state. As a last step, the same effects are numerically studied in the case of proton-rich nuclei using the single-particle energies of a deformed Woods-Saxon mean-field. It is shown that both the np pairing and projection effects decrease as a function of (N–Z). Moreover, it appears that the projection effect is more important in the np pairing case than in the like-particles one.

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P027: EXOTIC DECAY INVESTIGATION OF ND ISOTOPES

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Abstract

Exotic decay of axially symmetric even-even and odd-even Nd isotopes is studied. Hartree-Fock-Bogoliubov calculations with the recent UNEDF0 Skyrme interaction have been performed to determine the released energy for several clusters. The obtained energy is then used to calculate the cluster decay half-lives within the Unified Fission Model based on the Woods-Saxon potential. The results are compared with the half-lives computed in the framework of other theoretical models.

Cluster radioactivity, also called exotic radioactivity, is a rare intermediate process between alpha decay and spontaneous fission. It was predicted for the first time by Sandulescu et al. [1] in 1980 and was observed by Rose and Jones [2] in 1984 in the radioactive decay of ^{223}Ra by ^{14}C emission with a half-life of 3.7 ± 1.1 years. Later, several clusters such as ^{14}C, ^{20}O, ^{24}Ne, ^{28}Mg, and ^{32}Si were identified as being emitted from heavy nuclei decaying into daughter nuclei around the ^{208}Pb magic nucleus. Subsequently, a second island of cluster emitters was predicted in the tin region to yield daughter nuclei around the doubly magic nucleus ^{100}Sn.

The purpose of the present work is the study of Nd isotopes decay by the emission of clusters. First, the binding energy of these isotopes was determined from the Hartree-Fock-Bogoliubov calculations using the new Skyrme interaction UNEDF0 [3]. The quality of the obtained results confirmed the reliability of the calculations based on the UNEDF0 interaction and the possibility of using them for predicting the decay energy. The released energies, obtained by this interaction, were then used to calculate the disintegration half-lives of several clusters. The calculations were carried-out within the unified fission model in which the decay process is based on the quantum mechanical tunneling mechanism treated within the framework of the WKB approximation. The potential barrier is taken as a sum of the Coulomb, the centrifugal and the nuclear potentials by considering the latter as a modified Woods-Saxon potential [4].The results of our calculations are compared to those obtained by other theoretical models. It is shown that the emission of heavier clusters becomes more favorable for proton-rich Nd isotopes.

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TOPIC 2: RADIATION-ATOM INTERACTION

P028: NUMERICAL INVESTIGATION OF THREE-DIMENSIONAL INSTABILITY OF TITANIUM DOPED SAPPHIRE µ-PD FOR LASER APPLICATIONS

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Abstract
Fiber lasers are very important and have many applications in several domains [1]. Our study fits within the framework of the increasingly developing field of shaped crystals for laser applications. For this reason, a three-dimensional numerical study of the convection heat transfer, mass transfer, and flow instabilities in a simulated system is conducted.We have studied the proprieties of titanium doped sapphire crystal fibers drawn by a relatively recent growing technique [2, 3] that is the micro-pulling down (µ-PD). Our numerical study emphasizes on the optimization of the dopants concentration distribution (radial and axial) for increasing the coupling between the laser wave and the ions of the doping agent in order to give the highest possible luminous power at the output of the laser. We have chosen the material of titanium-doped sapphire used as amplifying medium in lasers [1] especially for high power fiber lasers and amplifiers.

***Keywords**: Laser, Titanium doped sapphire fibers, Amplifying medium, Instabilities, and Micro-pulling down (µ-PD) growing technique.*

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P029: FAR-WIN PROFILE OF PHOTO-ABSORPTION AND PHOTO-EMISSION SPECTRA OF CS (6P←6S) ATOMS PERTURBED BY HELIUM

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Abstract
Full quantum calculations are performed to determine the spectral broadening of the cesium D1and D2 lines induced by collisions with helium perturbers. The potential curves of the low-lying CsHe molecular states, as well as the corresponding transition dipole moments, are generated theoretically with ab initio methods based on SA-CASSCF-MRCI calculations, including the spin–orbit effectsand corrections of Davidson and BSSE. The emission coefficients at wavelengths lying between 800 and 1000 nm and temperatures ranging from 500 to 3000 K are determined. The emission spectral shape arises from the free–free and bound–free transitions. The resulting red- and blue-wing profiles are compared with previous experimental and theoretical works

P030: ORIENTATION EFFECTS ON THE FIVEFOLD AND FOURFOLD DIFFERENTIAL CROSS SECTIONS OF H_2S DOUBLE IONIZATION

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Abstract.

The fivefold and fourfold differential cross sectionsfor double ionization of the hydrogen sulfide molecule by 1 keV electron impact are investigated for three target orientations in space. We propose, here, a first Born approximation model based on partial wave function development in a coplanar geometry. In the inputl channel, we use a single-center molecular wave function to describe the molecular target state and a plane wave function for modeling the incident electron. In the output channel, the two ejected electrons are described by Coulomb wave functions coupled by the Gamow factor, whereas the scattered electron is simply described by a plane wave. The contributions of each H_2S^{2+} state to the double ionization process are studied in terms of shape and magnitude for different molecular orientations investigated, here. They are easily explained by the space orientation of the dominant atomic orbital in the molecular one. Furthermore, we identified the Shake-Off and the Two-Step 1 mechanisms involved in the double ionization process.

P031: MOLECULAR ORIENTATION EFFECTS ON MULTI-DIFFERENTIAL CROSS SECTIONS OF THE HCL DOUBLE IONIZATION BY ELECTRON IMPACT

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Abstract.

Multi-differential (fivefold, fourfold, triply and doubly) cross sections of double ionization of hydrogen chloride molecule impacted by electrons are investigated within the first Born approximation. The incident and scattered electrons are represented by plane wave functions, whereas the target is described by means of a single-center molecular wave function. In this work, we study the contributions to the DI multi-differential cross sections of the four outermost orbitals of the HCl, namely, 4σ, 5σ, $2\pi_x$, and $2\pi_y$, considering the case where the two outgoing electrons are ejected from two different subshells. We report a strong dependence versus the target orientation by pointing out the signature of the well-known DI processes, namely, the shake-off and the two-step 1 mechanisms. In specific cases, the similarities of the multi-differential cross sections are easily explained by the space-orientation of the dominant atomic orbital in the molecular one. Finally, the target orientation effects on the secondary electron energy distributions are reported and discussed.

P032: DIFFRACTION OF THE HERMITE-GAUSSIAN BEAMS BY A RECTANGULAR APERTURE

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Abstract

Based on the generalized Huygens-Fresnel diffraction integral,the propagation equation of Hermite-Gaussian beams through a rectangular diaphragm of variable aperture derived.The study results show that we can obtained

Hermite-Gaussian beam of lower order than the incident beam in a plane different from geometrical focal plane ,which is determined by the study of focal shift,where we used a new technique based on laser beam width assessment, and from the appropriate fits the diffracted beam is determined.

P033: MONTE CARLO SIMULATIONS OF VERY LOW ENERGY ELECTRON IN ALUMINUM

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Abstract

Secondary electron emission (SEE) following ions impact on solid surfaces have been studied for many years, over wide ranges of ion masses and energies. A Monte Carlo (MC) simulation of cascade processes of secondary electrons generation following the penetration of protons with energies less than 25keV in an aluminum target have been performed to investigate the energy distribution of backscattered electron in the energy range of 10-100eV. To test the reliability of this study, we have to investigate the electron transport in matter following the impact of low energy electrons. MC transport codes commonly rely on elastic and inelastic electron scattering cross sections. Elastic interactions are described by Mott cross sections within the framework of partial wave analysis whereas the inelastic scattering is described by the dielectric function based on the optical data. The validation of the model is performed by comparison with experimental measurement.

P034: EMPIRICAL FORMULAE FOR L_1, L_2, AND L_3 SUBSHELL CROSS SECTION BY PROTONS IMPACT WITHIN UPDATED EXPERIMENTAL DATA

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Abstract

The study of phenomena occurring in collisions between charged particles and target atoms has grown to a field of increasing interest in experimental aspects. This growing interest is due to the wide applicability of Particle Induced X-Ray Emission method (PIXE) in many fields. In this study, empirical L-shell cross-sections were calculated from the Existing experimental compilation for a wide range of elements by protons energy ranging from 0.3 to 10 MeV. These predictions are compared with other experimental and theoretical results for each subshell L1, L2, and L3.

Keywords:*L-shell cross-sections; empirical cross-sections;L-shell cross-sections.*

P035: SHAPING OF A LAGUERRE GAUSSIAN BEAM BY AN ANNULAR APERTURE

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Abstract
The numerical simulation of higher order radial Laguerre-Gauss LG_{P0} passing through an annular aperture by using the Fresnel–Kirchhoff integral will be studied. Meanwhile, the cases of circular aperture and black screen (stop) will be given. A lot of numerical examples will be given to illustrate the propagation characteristics of Laguerre-Gaussian beams.

P036: DETECTION AND IDENTIFICATION OF AEROSOLS AND CLOUDS BY LIDAR

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Abstract
The aim of this work is to give the vertical distribution of atmospheric aerosols and the altitude of the clouds from the Lidar (Light Detection and Ranging) observations. The lidar emits a laser signal in the atmosphere at a wavelength of 532 nm. The backscattered signal by the aerosols and clouds allows the determination of the vertical extinction profils (σ_{ext}) as well as the extinction to backscatter ratio (RL). In this work, we used measurements performed by the Lidar of Tizi-Ouzou installed on the roof of the LAMPA laboratory of the University of Tizi-Ouzou (36.69 ° N, 4.05 ° E). The results obtained during August 22^{cd}, 2012 (clear sky) and October 29, 2013 (cloudy skies) show that RL vary between 10 to 87 sr. In October 29, two strong values of the extinction were observed. The first one exceeds 0.6 Km^{-1}, it characterizes thick clouds observed at an altitude between 8 and 12 Km and other less thick clouds observed at an altitude ranging from 4 to 5 Km. The second one is about 0.47 Km $^{-1}$, it corresponds to an aerosols layer observed in the lower atmospheric layer (<1 km) with an LR of 62.6. During August 22^{cd}, two layers of particles are clearly shown, one below 1 Km with a RL of 63.6 and a σ_{ext} of 0.45. Another less dense layer is between 1.5 and 4 km with values of LR and a σ_{ext} of about 22.2 and 0.24 respectively. These two aerosol layers represent respectively fine particles which are urban aerosols and coarse particles which are desert dust transported from the Sahara.

P037: STUDY OF THE SCATTERING OF SLOW H^+ IONS FROM A NICKEL SURFACE

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Abstract
Our aim is to calculate thescatteringprobability of slow ions (a few keV) from a solid surface by taking into account the energy loss effect. We used a model based on the resolution of the Boltzmann equation in the transport theory frame. We present results on the scattering of H^+ (4 keV) ions from a Nickel surface for slow values of the incident and scattering angles.

P038: ANGULAR DISTRIBUTIONS FOR ELECTRON ELASTIC SCATTERING BY HYDROGEN CHLORIDE MOLECULE

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Abstract

We report theoretical doubly differential (angular distribution) and integrated (energy distribution) cross sections for electron elastic scattering by hydrogen chloride molecule over wide impact energies ranging from 10 eV up to 20 keV, where the non-relativistic theory is available. The calculations are performed by considering a target molecular state described by means of single-center molecular wave functions, within the partial-wave formalism by means of a spherical optical potential model taking into account a static contribution deduced from a single-center Hartree-Fock target description as well as fine effects, like correlation-polarization and exchange contributions. The theoretical results obtained in this model pointed out clearly the role played by the exchange and correlation-polarization potentials, particularly at lower incident energies. The numerical results, obtained in this parameter free model for both doubly differential and integral cross sections for electron scattering by HCl molecular target, are compared with the available experimental data and satisfactory agreements are observed in the whole energy range.

P039: RADIATIVE ASSOCIATION OF ^{36}Ar AND ^{38}Ar WITH IONIC HYDROGEN

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Abstract

In a recent paper written by Barlow et al. [Science 342, 1343 (2013)], the ArH+ ionic system has been detected in the Crab Nebula. We accordingly propose in this work to examine the radiative association of the argon atoms 36Ar and 38Ar with ionic hydrogen H+ and to calculate the related temperature dependent rate coefficients. To do so, we have to construct the potentialenergy curves via which both Ar and H+ species approach each other and the permanent dipole moments. The corresponding data points are borrowed from the recent and reliable results of Stolyarov and Child [PCCP 7, 2259 (2005)].

Once the curves are constructed, the rate coefficients are computed quantum mechanically and analyzed in the temperature range 1 − 10000K.

Keywords : *Radiative Association, Transition Dipole Moments, Potential Energy Curves, The Radiative Association Rate coefficients.*

P040: EXPERIMENTAL SPECTROSCOPIC STUDY OF 4,6-DICHLORO-2-METHYLPYRIMIDINE COMPARED TO THEORETICAL RESULTS

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Abstract

The aim of our group is to understand the behavior of the methyl group from the study of molecules exhibiting great symmetry.

In this part of the work, we present the crystal structure of 4,6-dichloro-2-methylpyrimidine which is solved from X-ray diffraction from a single crystal at room temperature. In parallel with the experimental study, we carried out theoretical calculations of the conformation of the molecule isolated from the DNM using the methods of DFT (Density Functionnal Theory).

Calculations of optimization of the molecular conformation of 4,6-dichloro-2-methylpyrimidine using the program chain Gaussian and the functionals B3LYP, MPW1PW91 and the bases 6-311 gave a conformation C1 with results very close to the experiment for the lengths and For the connecting angles. For the conformation of 4,6-dichloro-2-methylpyrimidine, the calculation results obtained from the functional B3LYP, MPW1PW91 and the basic set 6-311 give a good agreement .

The Raman and infrared spectroscopy calculations undertaken from the optimization results using the same functionalities B3LYP, MPW1PW91 and the sets of base 6-311 to values of frequencies very close to the experimental results.

Keywords: *Spectroscopy, DFT, Conformation, Infrared, Raman.*

P041: SODIUM LASER GUIDE STAR "LGS" SYSTEM IN THE E-ELT

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Abstract

Extremely Large Telescopes are considered worldwide as one of the highest priorities in ground-based astronomy. They will vastly advance astrophysical knowledge, allowing detailed studies of subjects including planets around other stars. Dubbed E-ELT for Extremely Large Telescope, this revolutionary new ground-based telescope concept will have a 39-metre main mirror and will be the largest optical/near-infrared telescope in the world.

The performance of terrestrial telescopes in the visible domain is infected by atmospheric turbulence, it reduces the angular resolution of large telescopes (diameter of 8m and more) to that of telescopes a few centimetre's in diameter (10-20cm), Adaptive Optics (AO) is the best solution to this problem. It corrects in real time the deformations caused to the wave front of the light coming from astronomical objects, the (AO) uses as a reference the natural stars but they are few in number.

Natural stars that can serve as a reference for (AO) systems are few in number. The solution adopted by most large terrestrial telescopes is the artificial reference star produced by a laser-sodium-mesospheric (LGS) interaction, thanks to this technique, coverage of 100% of the sky is ensured by The "AO-sodium LGS" system.

P042: AB INITIO CALCULATIONS OF HYPERFINE STRUCTURES IN CHLORINE ATOM

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Abstract

For the first time, ab-initio calculations are performed to study the hyperfine interaction in the excited states 3p4 4s 4P and 3p 4 4p 4D of 35Cl.

The wave functions associated with the two states are calculated using the nonrelativistic multiconfigurationnel Hartree-Fock (MCHF) method, whereas the influence of the relativistic effects on the hyperfine structures of the states are analyzed through the Breit-Pauli approximation (BP).

We carried out several types of MCHF calculations with the purpose of highlighting the nature of the effects of correlation that describe correctly the hyperfine interaction in these two atomic states of chlorine.

The first results obtained show that the relativistic effects are negligible in the two states while the correlation valence-valence seems to play a dominant role .

These first conclusions rest on the comparison of our theoretical values to the existing experimental values and between which we can note a satisfactory agreement.

P043: STRONG RELATIVITY EFFECT ON THE A3/2 HYPERFINE CONSTANT OF 2P4(3P)3P 4S FLUORINE ATOMIC STATE

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Abstract

Multiconfiguration Hartree Fock (MCHF) and multiconfiguration Dirac-Hartree-Fock (MCDHF) calculations are performed on $2p^4(^3P)3p\ ^4S$ state of fluorine to determine its hyperfine constant $A_{3/2}$. Several computing strategies are considered to include correlation and relativistic effects. Higher-order correlation effects are included through SD-multireference MCHF calculations based on a careful selection of the largest components of the single reference MCHF wave functions to define the multireference sets. Relativistic effects are evaluated using the Breit-Pauli approximation (BP). A similar strategy is used for the calculation of MCDHF relativistic wave functions and hyperfine constant.

The two relativistic appoaches (BP and MCDHF) reveal a strong effect of relativity on the hyperfine structrure of the state. The correlation effects are also important since at the Hartree-Fock level the state has no hyperfine structure.

P044: SYNTHESIS AND CHARACTERIZATION OF TRANSPARENT ER^{3+}DOPED TEO_2-K_2O-NA_2O-NB_2O_5GLASS CERAMIC

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Abstract

Glass-ceramics are polycrystalline ceramic materials, formed through the controlled nucleation and crystallization of glass. They have many advantages with respect to semiconductors and rare earth-doped single crystals. They can provide very good mechanical properties, better transparency in (UV-VIS-NIR) region, ease of shaping and low cost of production. It is for these reasons that many research groups have paid particular attention to this type of material [1-3].

Transparent tellurite nano-glass-ceramics made photoluminescent by doping with Rare-Earth (RE) ions have been shown recently to be promising materials for new optical devices [4]. These materials are easier to prepare than single crystals and can be made in a wide variety of shape and size. We have selected a tellurite-based glass composition, TeO_2-K_2O-Na_2O-Nb_2O_5 (TKNN), because it shows advantageous optical properties due to excellent properties on photonic devices applications such as low melting temperature (~800 °C), high refractive index (~2) adequate for nonlinear effects (harmonic generation), low phonon energy (~600–700 cm^{-1}) that increases the fluorescence efficiency by limiting nonradiative relaxations, large transmission window (350–6500 nm) and can be easily fiberized [5-7]. Furthermore, crystallized glass fabricated using this composition shows nanocrystallization with a high level of transparency and second harmonic generation (SHG) [8, 9]. The present

work deals with preparation of new Er^{3+}-doped transparent glass ceramics from melt-quenched glasses with general composition of TKNN. The as prepared glasses after annealing at glass transition temperature (Tg) were further annealed at different temperatures for ceramization using DSC and XRD. It was found that the crystallization mechanism depends strongly on annealing temperature. The optical absorption and emission revealed an intense and broad emission band centered at 660 nm under polarized laser at 542 nm.

***Keywords**: Glass-ceramics, Tellurite glasses, polycrystalline, nanocrystallization, upconversion, second harmonic generation.*

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P045: JUDD-OFELT ANALYSIS OF LUMINESCENCE EMISSION FROM $LI_6EU_{1-X}SM_X(BO_3)_3$ SINGLE CRYSTAL

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Abstract

Due to its pure dipolar magnetic transitions from the ground state and the absence of degeneracy of the ground state and of the $^5D_0$ level, trivalent europium (Eu^{3+}) ion is the most significant luminescent probe to investigate its symmetry in the lattice [1]. Further this may give information on crystal structure, order-disorder problems [2], and also the difference between chemical bonds in solids. The optical spectrum of a lanthanide ion is closely related to the particular local symmetry of the environment occupied by this ion in solid matrices.Eu_2O_3-doped phosphors are commonly used in field emission technology and LEDs, which exhibit higher luminescence efficiency compared with other luminous materials [3–5]. Eu^{3+} as a laser active media will have prospective application for vast several ranges such as Y_2O_3:Eu^{3+} [6].

Laser crystals are usually evaluated by emission cross-section and fluorescence lifetime. These properties are calculated using intensity parameters Ω_t(t=2, 4, 6) based on the Judd–Ofelt theory [7]. The Judd–Ofelt (J-O) parameters contain odd crystal field terms, radial integrals and perturbation energy denominators and are related to local structure and chemical bonding surrounding rare-earth ions in crystals. However, some transitions in Europium ions provide another challenge to the standard Judd-Ofelt (J-O) theory because they violate the selection rules [8, 9]. Some of these transitions are primarily magnetic dipole in nature, but do occur as electric dipole transitions with low intensity in some materials.

We reported for the first time, a detailed study of luminescence properties of LSEB. The emission cross section, J-O parameters, and radiative lifetime were examined in relation to practical applications as materials emitting visible light.

***Keywords**: Dipolar magnetic, electric dipole, luminescent probe, laser crystal, crystal field, bonding surrounding, Judd-Ofelt (J-O), J-Mixing, cross section.*

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P046: OPTOELECTRONIC PROPERTIES OF PEROVSKITE COMPOUNDBIINO$_3$

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Abstract
We present a study of the structural, electronic, optical properties of the orthorombic $BiInO_3$ structure within the local density approximation of density functional theory using full potential LPW. The calculated equilibrium lattice constant, angle and atomic position are in reasonable agreement with the available experimental and theoretical dates. The optical response of $BiInO_3$ are also inspected by computing the complex dielectric function, refractive index, absorption coefficient, extinction coefficient, reflectivity and optical conductivity for radiation with energy up to 16 eV. Therefore, we hope that our calculated results could serve as a reference for future experimental study and develop the optical applications of $BiInO_3$.

P047: A STUDY OF THE ELECTRONIC AND OPTICAL PROPERTIES OF PEROVSKITE COMPOUNDBIGAO$_3$(BGO)

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Abstract
Bi-containing perovskites materials such as $BiAlO_3$, $BiGaO_3$ (BGO), $BiInO_3$, $Bi_4Ti_3O_{12}$, $BiFeO_3$, and $BiMnO_3$ have received a lot of attention as lead-free ferroelectrics, ferromagnetic, and photovoltaic materials. In this work, we focus on the structure, electronic, and optical properties of orthorhombic $BiGaO_3$ using the density function theory. The structural parameter calculated using the generalized gradient approximation (GGA) to the exchange-correlation potential. To calculate the electronic properties, the exchange-correlation potential is treated with GGA, we find that the newly developed Tran-Blaha-modified Becke-Jonson functional signification improves the band gap. Furthermore, the absorption spectrum, refractive index, extinction coefficient, reflectivity, energy-loss spectrum, and dielectric function were calculated. Therefore, we hope that our calculated results could serve as a reference for future experimental study and develop the optical applications of $BiGaO_3$.

P048: EFFECT OF WAVEGUIDES ON THE ELECTROMAGNETIC FIELD, COMPARISON BETWEEN ANALYTICAL AND NUMERICAL APPROACHES

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Abstract

Optical waveguides can be classified according to their geometry (planar, strip, fiber waveguides…), mode structure (single-mode, multi-modes) and refractive index distribution (step or gradient index). Study of the effect of these optical elements on the electromagnetic field can be performed using analytical and numerical methods.

In this work, field distribution in different kinds of optical waveguides is shown and a comparison between analytical and numerical approaches is then made. Advantages and disadvantages of each approach are deduced.

Keywords: *waveguides, electromagntique field.*

P049: THEORETICAL ANALYSIS OF VISIBLE AND NEAR-INFRARED SURFACE PLASMON RESONANCE PROPERTIES

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Abstract

Theoretical investigation of the conventional surface plasmon resonance (SPR) technique for biological studies utilizing visible and near-infrared (NIR) excitation from 600 to 1500 nm is described. Surface plasmon resonance (SPR) has been widely used for sensing applications. SPR sensor systems are usually implemented in the Kretschmann–Raether prism geometry, with the use of visible light and a glass prism. The study compare different prism materials, including dielectrics BK7 and ZnS glasses.

P050: APPLICATION OF LASER IN A OPTICAL ASSEMBLYFOR CALCULATION OF DEFORMATIONS FOLLOWING THE X AND Y DIRECTIONS

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Abstract

This work presents the use of a laser in a optical assembly for detection of deformation of a part following the x and y directions. For this we has used the method of electronic speckle interferometry ESPI, which is an optical method non-destructively which requires two states a state before deformation and the other after deformation also a wave object and a wave of reference; this mounting is menu a CCD camera that is connected to a computer.

P051: SIMULATION CALCULATIONS OF LINE SHAPES IN PRESENCE OF STRONG LANGMUIR TURBULENCE

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Abstract

An atom immersed in a plasma affected by strong Langmuir turbulence may be perturbed by a sequence of wave packets with a maximum electric field magnitude large compared to the equilibrium plasma microfield. For such conditions, we propose to calculate the shape of the hydrogen Lyman α, β and Belmar α line with a numerical integration of the Schrödinger equation coupled to a simulation of a sequence of electric fields modeling the effects of the wave packets. Several line profiles are presented and discussed for different conditions of Tokamak and astrophysical plasmas, and of the wave packets electric field magnitude.

P052: SPECTRAL LINE SHAPES IN MAGNETIZED PLASMAS: APPLICATION TO PLASMAS OF TOKAMAK EDGE

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Abstract

In order to understand the mechanisms of energy production studied in international research programs on thermonuclear fusion by magnetic confinement, continuous progress in this field has led physicists to construct machines in which a strong magnetic field ensures plasma confinement. Our work lies within this framework, where the objective is to describe spectroscopic techniques applied to magnetic fusion plasmas. These techniques, are based on the use of line spectra which are affected by the Stark and Doppler broadening and by the Zeeman effect, allow to determine the parameters of emissive plasmas. The first means of studying these plasmas is the analysis of their radiation. It is based on the comparison of observed and modeled spectra allowing to partially decrypt the hidden information. The atom or the emitting ion plays the role of the probe introduced into the plasma. When this probe reacts significantly with the surrounding plasma, the information to be extracted is transported by the spectra of the emitted lines. Most of the studies devoted to the study of the profiles concern only the Stark effect [1]. Today, many plasmas are found where magnetic fields reign: Astrophysics (magnetic stars, white dwarfs, neutron stars), plasmas High energy and density created by laser, magnetic fusion (tokamak, stellarator, pinch). More researches continue in the margin [2-5] for plasmas in the presence of the magnetic field (Stark-Zeeman effects combined). This combination of the Stark and Zeeman effects and the influence they produce on a line shape presents a crucial subject of fundamental research. The Stark-Zeeman broadening of the spectral line shapes of hydrogenoid ions is of great interest for density and temperature diagnoses in fusion experiments by magnetic confinement. In these experiments, there are few direct methods for measuring the density and the temperature; hence we need to develop theoretical methods exploiting spectral lines. In this work we have taken up the previous work of Nguyen-Hoe and his collaborators [6] on the Lyman-ra line and introducing the effects of the internal structure of the emitter, the effects due to the Lorentz field) and the effects due to the movement of the emitter (Doppler effect), we developed a model which allowed us to obtain spectral line comparable to those observed on the Tokamak edge. We applied our model to the isotopes of hydrogen observed in the Tokamak Tore Supra plasmas, which are simultaneously subjected to the Stark, Zeeman and Doppler effects. We show that [7] for certain plasma conditions, the width of these lines depends both on the temperature of the emitter, on the local electrical micro-field of the plasma, and on the magnetic field. A good overall agreement was obtained between the calculated spectrum and the observation. The experimental lines were modeled using the theoretical profiles taking into account the Doppler, Stark and Zeeman effects. This analysis shows that it is necessary to take into account at least two populations of distinct deuterium atoms. Our model allowed the diagnosis of the different populations of neutrons of deuterium as well as the simultaneous determination of several parameters of the plasma.

Keywords: *Spectral lines, Doppler effect, Stark, Zeeman, Stark-Motionnel effect, Lyman-α, Tokamak.*

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P053: OPTIMIZATION OF THE EMISSION LINE SHAPE OF HE-NE GAS LASERS

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Abstract

It is well known that, He-Ne gas lasers are characterized by an emission line shape, with a Lamb dip generally asymmetric. The inhomogeneities of saturation and population are at the origin of the asymmetry of the line and it is the predominant effect, which fixes the asymmetry type. As it was shown before, the geometrical parameters of the cavity and the gain greatly influence the two types of inhomogeneities and concur to favor one or the other type. In some favorable cases, the two effects compensate each other, for a given gain, and the line shape is then, symmetrical.

Our aim is to show with the aid of the elaborated model, which is based on the approximation of the perturbed Gaussian beam, some of these favorable cases, by changing some geometric parameters of the cavity, such us ; the radius of curvature and also, the reflection coefficients in amplitude of the mirrors. This study has been applied to a He-Ne laser operating at 3.39 μm.

TOPIC 3: ANALYSIS TECHNIQUES

P054: IONOSPHERIC DISTURBANCES OF ELECTRIC FIELD MEASUREMENTS INDUCED BY ELECTRIC SENSOR AND SOLAR PANEL CONNECTION

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Abstract

This study attempts to analyze the problem of ionospheric disturbances of electric field measurements. These disturbances are induced by the connection between electric sensors and the solar panel through a magnetic tube of force. When a magnetic line of force passes through the solar panel by coupling one of sensors, there will be a stream of high energy electrons and the plasma disappears in the tube of force. This effect reduces the electron current collected by the sensor.

Our results indicate that the potential of the magnetically short-circuited sensor becomesmore positive to maintain the polarization current at its constant level. This can be qualitatively understood by the very fast depletion of electrons in the magnetic flux tube between the sensor and the solar panel due to their large thermal velocities. The polarization current of others sensors free from magnetic short-circuit with the solar panel must stay at a constant potential with respect to the local plasma potential. Since their voltages measured with respect to spacecraft ground increase, this implies that the spacecraft equilibrium potential must decrease. This modifies the overall potential equilibrium of the spacecraft and becoming more negative.

Finally, we can deduce that the current collected by the probe when its tube of force intersects solar panel is decreased, electrons disappear from within the connected tube of force and current decreases, thus polarization voltage should increase.

Keywords: *Solar panel, Electric sensor, ionospheric plasma, Electric field.*

P055: CHARACTERIZATION AND REHABILITATION OF POLLUTED SOILS WITH BIOSILICA MATERIAL BY CALCINATION

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Abstract

The sludge treatment is a difficult phase in the fight against pollution. Indeed, the scrubber with a difficult problem was solve for many reasons: scarcity of land available for application and filing need set requirements of the environment and public hygiene. Moreover, the economic importance of this problem is illustrated by the importance of the cost, both in investment and operating it can represent. Oily sludge with a significant calorific value which represents 90% of methane (CH_4) can be considered as an interesting fuel. The impact related to its combustion in poor conditions can be important. The objective principal of this study is of thermally treat sludge oily of the oil industry at the level of the RA1/Z refinery and then make a characterization of sludge by: x-rays fluorescence (XRF) to determine the mineralogical composition in mass in the form of oxides e.g. percentages (% SiO_2 , % CaO, % Fe_2O_3 , % K_2O, etc...). x-rays diffraction (XRD) for sentencing phases for example: silica crystalline or amorphous, Fourier transformed infrared spectroscopy in mode attenuated total reflection (FTIR-ATR) to determine functional groups for example: O - H, C - H, C - Cl, Br - C, C - I, C - N, N - H etc...) , and finally detection of heavy metals by atomic absorption spectroscopy (AAS). In a second part we're interested in studying the operating constraints due to the presence of the sludge contaminated as well as health risk and environmental.on is interested to identify different Condit's other than agricultural spreading with the using of an

alumino-silica material natural adsorbent very abundant and cheap as catalytic support named diatomite is a rock formed mainly by the accumulation of the frustules of diatoms called "Kieselguhr" in the Sig of the Algerian Western oilfield with the advantage of being available locally and less expensive. Diatomite gross of Sig 'DB' which will be changed by ferrihydrite "filing of ferrihydrite on raw diatomite DB by chloride ferrous tetrahydrate $FeCl_2.4H_2O$ with different concentrations and the surface modification by treatment with lye (NaOH) to increase the specific surface of raw diatomite DB and we add the burned-out mud..." The products obtained are named (DMF3). Analytical results which are: x-ray fluorescence (XRF), x-ray diffraction (XRD), Fourier transformed infrared spectroscopy withatenuated transform reflection (FTIR -ATR) : ferrihydrite modified diatomite (DMF3) contain continuously oxides in different phases which are: ferrihydrite, hematite, lepidocrocite, goethite, schwertmannite, ferroxhyte, akaganeite, ferroxyde, and magnetite. The observation with scanning electron microscopy (SEM) shows that DMF3 Central particles have diameters approximately between 3-6 µm, and pinnate DMF3 particles have lengths approximately between 4-9 µm.

Keywords: *sludge, agricultural spreading, diatomite, ferrihydrite.*

P056: ORIGIN OF ULTRA HIGH ENERGY COSMIC RAYS

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Abstract

Ultra high energy cosmic rays are the most energetic particles ever observed in nature. With energies exeeding 10^{20} eV, they are obviously produced by the most violent phenomena in the Universe. The origin of this huge energy particles and their acceleration process still not known. In our work, we study the possibility that these particles are coming from nearby starburst galaxies. This scenario is supported by the TA experiment of a cosmic ray excess not far from the direction of the starburst galaxy M82. We use the Monte Carlo publically available code CRPropa, to study the propagation of ultra high energy particles, taking into account all relevant particle interacions, and also deflections by galactic and extragalactic magnetic fields. The obtained results on all particle energy spectrum, cosmogenic particles and anisotropy are compared with recent data from the TA and Pierre Auger observatories. The starburst galaxy scenario reproduces very well the observations, making it very attractive for explaining the origin of cosmic rays at the highest energies.

P057: EXTENSIVE AIR SHOWER OF ULTRA HIGH ENERGY COSMIC RAYS

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Abstract

Nowadays Ultra High Energy Cosmic Rays (UHECRs) is a subject of intense research of great interest.

All current investigations (Auger experiments, TA (Telescope Array) and soon Jem-Euso) try to answer the main questions concerning UHECR's are: What are they? Where do they come from? How do they acquire such colossal energies**?**

The origin of the ultra high energy cosmic rays (UHECR) with energies above 10^{19} e V remains a mystery. The discovery of their sources will certainly reveal the most energetic astrophysical accelerations in the universe.

In this work detailed simulations of extensive air showers have been carried out with the CORSIKA (CONEX) program in order to evaluate the depth of the shower maximum. This parameter and its fluctuations are very sensitive to the nature and the energy of the primary particle.

P058: FT-RAMAN, FT-IR SPECTRA AND DENSITY FUNCTIONAL THEORY (DFT) STUDIESOF 2.4.5- TRIMETHOXYBENZALDEHYDE $C_{10}H_{12}O_4$

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Abstract

The FT-IR and FT-Raman spectra of 2.4.5-trimethoxybenzaldehyde C10H12O4 molecule have been recorded in the range of 4000–400 cm-1 and 3500–50 cm-1 respectively. The molecular geometry and vibrational frequencies in the ground state are calculated using the DFT/B3LYP method with 6-31G (d) and 6-311G (d) basis sets and assuming CS symmetry. The computed values of frequencies are scaled using a suitable scale factor to yield good coherence with the observed values.

In the Raman spectrum, the extremely intense line at1018 cm-1 and two other strong bands at 835 and 658 cm-1 are generated by the phenyl ring vibrations. In the IR spectrum two strong and sharp bands at 1474 and 1443 cm-1arise from the mixed ip(C–H) in-plane bending vibrations, while the very strong IR band at 747 cm-1 is assigned to the out-of plane op (CH) vibrations.

The agreement between the calculated and experimental frequencies is very good: always better than 97% for the observed skeletal vibrations. The calculations overestimate the methyl frequencies by 7%, and experiment shows only broad features for these excitations.

The presented assignments of the IR and Raman spectra will be helpful in the spectroscopic studies of other compounds.

Keywords: *FT-Raman, FT-IR, DFT calculation, 2.4.5-trimethoxybenzaldehyde*

P059: STUDY OF PARTICLE TRAJECTORY BY HOLOGRAPHY AND LABVIEW

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Abstract

The digital holography by its detection sensitivity, its adaptation to shapes and types of objects, plays an important role in modern metrology. As a three-dimensional imaging technique, it is applicable in the 3D measurement in fluid mechanics citing HPIV.

This memory presents the built of a digital holographic off-axis two views set-up. The processing of the obtained holograms leads to extract tracer particle positions by using coordinates in both direct and orthogonal views. Furthermore, it is possible to achieve a 3D reconstruction by crossing coordinates of the two views.

In the goal to track particles, a hologram series were recorded using software constructed under LabVIEW with which, we can define the number and space between recordings. Numerical analysis of the reconstructed holograms leads to obtain the trajectories of these particles during their falling down in the volume of study.

P060: THE GAMMA IRRADIATION FACILITY FOR SPACE RESEARCH

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Abstract

A multipurpose Co^{60} Gamma Irradiation Facility has been reconstructed and upgraded at the Research Centre Rez Ltd., Czech Republic. The irradiation facility consists of gamma source, irradiation chamber and experimental box of dimensions 350 x 500 mm. The experimental setup includes the ability of sample exposure to 172 TBq γ-sourceradiation in variable temperature ranging from -196 °C to 400 °C in a vacuum of up to 10^{-6} torr. One of the most interesting research topics is space research. Low temperature, vacuum and radiation altogether form conditions similar to the space environment.This experimental setup can be used for samples of any material and technologies such as electronic devices and equipment, cosmic detectors and coatings for space materials etc. This paper discusses the current status, insights and trends into continuous use of the cobalt irradiation facility.

P061: POLYELECTROLYTE LIKE BEHAVIOR OF A POST GAMMA IRRADIATED NEUTRAL POLYMER DISSOLVED IN WATER

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Abstract

The aim of this work is to study the electrical conductivity behavior of a post gamma irradiated neutral polymer, polyvinylpyrrolidone (PVP), dissolved in water. In fact, the PVP was irradiated by a ^{60}Co-gamma radiation with different doses ranging from $0.8kGy$ to $50kGy$. Then, the irradiated polymer, $PVP*$, was dissolved in water in order to prepare aqueous solutions with different concentration ranging from $0.213*10^{-2}\,gdl^{-1}$ to $1.0654*10^{-2}\,gdl^{-1}$.For all the prospected samples, the electrical conductivity was measured at $25°C$ versus elapsed time from $PVP*$ dissolution in water. An exponential variation of the electrical conductivity versus elapsed time was observed and so an empirical equation was proposed where we distinct two regions (1): a transitional regime, where the conductivity increases from its initial value $\sigma_{PVP^*,i}$. (2): a permanent regime, where the conductivity remains constant at its high value $\sigma_{PVP^*,\infty}$. The rapidity of establishment of the permanent regime was characterized by a time parameter, τ. This parameter depends on irradiated polymer concentration and dose values. In the permanent regime, the $PVP*$ in water behaves like a polyelectrolyte, this is due to the scission of the polymer chains under gamma radiation.

P062: SYNTHESIS AND PHYSICOCHEMICAL CHARACTERIZATION OF A MATERIAL BY DIFFERENT ANALYTICAL TECHNIQUES

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Abstract

In this work, the preparation of the copper-iron doped mordenites was prepared by the ion exchange method.

The mordenite zeolite was synthesized from an aluminosilicate gel of stoichiometric composition: 6Na 2 O / Al 2 O 3 / SiO 2/760 H 2 O, prepared from synthetic sources: aerosil silica (Degussa) and sodium aluminate (Riedel de Haen). Crystallization of the synthesis mixtures was carried out at 170 ° C. under autogenous pressure. Their functionalization by incorporation of ions such as copper and iron was carried out by ion exchange. For the purpose of identifying the structures of the synthesized samples and predicting their behavior in the preparation of the catalysts, the samples were analyzed by DRX Infrared Spectroscopy, Nitrogen Adsorption and EDX Electronic Microprobe, And volumetric analysis by nitrogen adsorption.

The experimental results showed that the materials prepared are very pure and capable of being tested for the application.

Keywords: *mordenite, synthesis, ion exchange, iron, copper, infrared*

P063: CALCULATION OF AVERAGE M SHELL FLUORESCENCE YIELDS FOR HEAVY ELEMENTS

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Abstract

Accurate experimental data regarding the X-ray production (XRP) cross sections, ionization cross sections and the fluorescence yields are very important because of the large number of their applications in various areas of physical chemistry and medical research. Therefore, an accurate average M-shell fluorescence yield ($\overline{\omega}_M$) is required for these applications. We have calculated the average M-shell fluorescence yield using the experimental data measured by different groups covering the period from1955 to 2005. We have interpolated these values of the experimental data by using the analytical function $\left(\overline{\omega}_M/\left(1-\overline{\omega}_M\right)\right)^{1/4}$ as function of the atomic number (Z) to deduce the empirical average M-shell fluorescence yield in the atomic range of 70≤Z≤92. The results have been compared with other theoretical, experimental and empirical values reported in the literature and a reasonable agreement has been obtained.

Keywords: *Average M-shell fluorescence yield; empirical fluorescence yields.*

P064: NEW PROCEDURE CALCULATION OF L2 SUBSHELL FLUORESCENCE YIELDS FOR ELEMENTS FROM$_{40}$ZR TO $_{60}$ND

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Abstract

L X-ray fluorescence cross sections and fluorescence yields are important for developing more reliable theoretical models describing the fundamental inner-shell processes. Experimental, theoretical and empirical data regarding the X-ray fluorescence (XRF) cross sections and the fluorescence yields are also important in many practical applications, like elemental analysis by the X-ray emission technique, basic studies of nucleair and atomic

processes leading to the emission of X-rays and Auger electrons, and dosimetric computations for medical physics and irradiation processing. Over the years, a large quantity of experimental data were reported in the literature for L sub-shell fluorescence yields. Several researchers investigated ω_{L2} values by using different methods according to different experimental conditions such as ionization processes, target materials and type of detectors. The experimental values used in this work to calculate empirical data for elements from $_{40}$Zr to $_{60}$Nd relies on the published experimental data. The experimental data ($\omega_{L2\text{-}exp}$) of the L2 subshell fluorescence yields were directly interpolated to deduce the empirical values. So an interpolation using the famous analytical function $\left(\omega_{L2\text{-}exp}/\left(1-\omega_{L2\text{-}exp}\right)\right)^{1/4}$ vs the atomic number Z was proformed to deduce a new empirical *L2* sub-shell fluorescence yields for elements in the range 40≤Z≤60. At last, our calculated empirical L2 subshell fluorescence yields have been compared with other theoretical and empirical values reported in the literature.

Keywords:*L2 sub-shell fluorescence yield, empirical calculations.*

P065: K-SHELL PRODUCTION CROSS SECTIONS FOR 2-5 MEV ALPHA ON ELEMENTS WITH Z= 25 TO 30

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Abstract

During the last decades, the study of phenomena occurring in collisions between charged particles and target atoms has grown to a field of increasing interest in both its theoretical and

experimental aspects. This growing interest is due to the wide applicability of Particle Induced X-Ray Emission (PIXE) in many fields. When performing sample analysis by PIXE, one of the essential factors is the production cross section or the ionization cross section on which relies to a great extent the quantitative PIXE analysis. In this paper, we report a new empirical formula to calculate K X-ray production cross sections by alpha-particles impact for elements with atomic numbers 25≤ Z≤30. In this formula, we introduced two parameters dependence, the atomic number Z and the projectile energy E (MeV). Our results for empirical K X-ray production cross sections are presented for selected elements and compared with other experimental as well as theoretical results; theoretical production cross sections calculated by using a personal computer program based on the ECPSSR model; and semi-empirical "reference" values. Generally, the obtained results are in agreement with theoretical prediction, reference values and with the experimental results.

Keywords: *PIXE, K X-ray production cross section; ECPSSR; fitting; empirical cross section.*

P066: MONTE CARLO MODELLING OF THE HEAD OF VARIAN CLINAC 2100C LINEAR ACCELERATOR OPERATING IN 18 MV UTILIZING GEANT4/GATE

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Abstract

In this study, the geometry of the head of VARIAN CLINAC 2100C linear accelerator has been modeled using GATE/GEANT4 version 7.2. The model developed contains the majority of the components of the treatment head operating in 18 MV, such as : the target, the primary collimators, the flatting filter, the secondary collimators and the jaws. Using this model, associated with a water phantom of type RFA 200 with dimensions 63x40x44 cm^3 situated at a Source-to-Surface-Distance (SSD) of 100 cm, the interactions of the 18 MV radiations in water were simulated. The Percentage Depth Dose and the beam quality specifiers, that characterize the high energy photon beams, such as D_{20}/D_{10}, %dd(10), d_{max}(cm), z_{80}(cm), for the field size of 10x10 cm^2 were calculated utilizing the phase space technique.

The results obtained in this study are in good agreement with those obtained in our previous work using MCNP5 code.

P067: EFFECT OF TEMPERATURE-PRESSURE ON THE THERMAL PROPERTIES OF THE ALLOTROPIC FORMS OF ZINC SULFIDE SEMICONDUCTOR

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Abstract

The small- gap semiconductors have application in the field of microelectronics. The wide-gap semiconductor materials are very important for application in the fields of optical device technology. Zinc sulfide is wide-gap semiconductor that is attractive material due to the polymorphic structural transformation and it is suitable semiconductor for applications in numerous areas like optics, electronics, photocatalysis. ZnS has been used widely as an important phosphor for photoluminescence, electroluminescence and cathodoluminescence devices due to its better chemical stability. In optoelectronics, it finds use as light emitting diode, reflector, dielectric filter and window material. ZnS nanostructures are expected to play a fundamental role on developing novel photovoltaic solar cells and creating "Green" renewable energy. In spite of the studies carried about ZnS, its thermal properties are seldom known. The free energy of crystals is essential to determine some thermodynamic quantities. So, for exemple to know the equilibrium concentration of vacancies (empty spaces) of crystals the semi-empirical method must be applied. To do this issue, a theoretical model associated with experimental measurement such as: X-Ray Diffraction spectra i.e. XRD and optical thechnique are required. Nowadays, after 2000, a current 2^{nd} revolution is revealed. It is the generalization of quantum mechanics concepts on the solids. In a parallel direction, the experimental characterizations and the power of calculations of computers are developed very rapidly. Owing to the development of the computational power of recent computers and the progress in the calculation method for the materials, it has become to calculate the properties of crystals with high exactness from first principles without any empirical parameters. Today, it is possible not only to explain the already known properties of a given material but also to predict what property will be expected for a hypothetical material.

We have performed density functional self-consistent calculations to investigate the structural, and thermal properties of three phases of ZnS. The computed ground state structural parameters, i.e. lattice constant, bulk modulus and its pressure derivative, are in good agreement with the available theoretical an experimental works. Thermal and pressure effects on some properties of ZnS polymorphs are predicted using the quasi-harmonic Debye model in which the lattice vibrations are taken into account. We have computed the variations of the volume, bulk modulus, thermal expansion coefficient, heat capacities, Debye temperature Grüneisen parameter and entropy with pressure and temperature. our results are well consistent with the available reported experimental data.

P068: THE EFFECTS OF Γ- RAY IRRADIATION ON STRUCTURAL PROPERTIES OF POLYETHYLENE TEREPHTHALATE

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Abstract

The effects of γ- ray irradiation on structural properties of polyethylene terephthalate (PET) has been studied using Fourier Transform Infrared Spectroscopy (FTIR). Several samples were prepared and irradiated at different doses (0.05 – 6.5 MGy) using ^{60}Co source of Nuclear Research Centre of Algiers, Algeria. The dose rate is about 1.3 kGy/h. It is found that the intensities of the different absorption bands decrease with increased γ- ray dose irradiation. The decrease in the intensity of the characteristic bands of the irradiated polymer is due to the rupture of the bonds and to the degradation of the structural properties. Moreover, the evolution of the specific bands of the trans and gauche conformations reveals a change in the amorphous and crystalline phases of the polymer.

P069: ENERGY DEPENDENCE OF FD-7 RPL GLASS DOSIMETER AND TLD LIF:MG,TI AND OSLD AL2O3:C DOSIMETERS FOR MEDIUM ENERGY X RAYS

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Abstract

The aim of this study was to compare the energy dependence of three kind of luminescent detectors without filter, Radiophotoluminescent(FD-7 glass) with thermoluminescent LiF:Mg,Ti (TLD-100) and Optically stimulated luminescent (Al2O3:C) dosimeters.

In this work, a Monte Carlo simulation with MCNP5 was carried out to estimate the energy responses of these dosimeters for medium energy X-rays beams for the energy range of 50-300 kVp and 60Co γ rays as the reference.

The current study are compared to previous results in literature. In kilovoltage photon beams, the dosimeters displayed an increasing response with decreasing energy with a significant over response factor at 70 kVp of RPLGD and Al2O3:C about 4.39 and 3.40 respectivelly, and a maximum of about 1.40 for TLD-100.

This study has clearly confirmed that, all three dosimetmers must be used an energy compensation filter in low energy X-ray (<250 kV).

Keyword: Luminescent detectors, RPLGD, LiF TLD-100, OSLD Al2O3:C.

P070: TRACE ELEMENT ZINC LEVEL IN HAIR AND NAILS OF ALGERIAN WOMEN WITH BREAST CANCER USING K_0-NAA

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Abstract

The main cause of cancer death in women worldwide is breast cancer. Trace element zinc can play a key role in the onset and prevention of breast cancer.

The purpose of this work is to determine the concentration of trace element zinc in hair and nails of Algerian women with breast cancer.

16 women with breast cancer and 08 age-matched normal controls were selected in this study. The concentration of the trace element zinc studied in hair and nails is determined using the instrumental neutron activation analysis technique. The range of concentrations of Zinc in the hair is between 119.3 and 215.6 µg/g for controls and between 81.73 and 666.9 µg /g for patients with increasing rate of 39.79 %. The application of t-test for both groups gives ($p > 0.05$) at the 95% safety threshold, between zinc concentrations in the hair of the two groups. The range of concentrations of Zinc in the nails is between 98.8 and 181.7 µg/g for controls and between 75.2 and 215.4 µg/g for patients with increasing rate of 1.75 %. The application of t-test for both groups gives ($p> 0.05$) at the 95% safety threshold, between zinc concentrations in the nails of the two groups. The influence of age on zinc concentration was determined.

Keywords: *INAA, Zinc, Hair, Nails, Brest cancer.*

P071: MONTE CARLO SIMULATION OF AN HPGE DETECTOR WITH MCNP5 CODE

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Abstract

In γ-ray spectrometry, HPGe detectors are widely used due to their high energy resolution. To establish the gamma detection efficiency curve for the determination of the activities of radioisotopes present in unknown samples, quantification [1] requires standard samples with the same geometry and composition which cover the energy range of interest. To avoid this constraint, Monte-Carlo simulation with MCNP5 (Monte Carlo Neutron and photon transport code) is suggested. MCNP5 code is powerful, flexible; however it requires the knowledge of physical parameters such as the dimensions and composition of the different construction materials of the detector and calibration sources [2]. In this work, the simulation concerns the new Canberra HPGe detector of the "Division des Techniques Nucléaires" in Nuclear Research Center of Algiers (CRNA). This detector is 30% relative efficiency and 1.75 keV FWHM at gamma energy of 1332.5 keV. The different above needed parameters were communicated by Canberra Industries. The experimental photopeak efficiency using voluminous standard ^{152} Eu source at 10 Cm was calculated to validate our simulated modelisation. Furthermore, true coincidence summing (TCS) correction factors are determined in closed detection geometry by comparing the simulated efficiency values to those determined experimentally.

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P072: INVESTIGATION AND IMPROVEMENT OF THE SOLUTION NEUTRON SPECTRUM AROUND AN ^{241}AM-BE BASED NEUTRON IRRADIATOR USING THE TRADITIONAL UNFOLDING PROCEDURE

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Abstract

Neutron spectrum unfolding, from the Bonner spheres measurements, is a challenging work since it requires skills and experience. Furthermore, as the results issued from the unfolding procedure are often sensitive and dependent on many parameters, in particular, to the default spectra used, it's important, therefore, to choose the adequate guess spectrum to initiate the iterative unfolding process of interest.

Thus, the main objective of this work is to study the sensitivity effects of the defaults spectra used in two traditional unfolding codes i, e. MAXED and GRAVEL on the final solution spectrum issued from Am-Be based neutron irradiator located at the Secondary Standard Dosimetry Laboratory (SSDL) of CRNA.

To this purpose, a sensitivity analysis was performed taking into account various default spectra provided from different cases: a) the photoneutron spectrum generated around a medical linear accelerator CLINAC 2100C; b) the neutron spectrum issued from Cf-D_2O based-source installed at the German institute of metrology (PTB), and c) the OB26 irradiation neutron spectrum obtained using a Bayesian software WinBUGS.

Hence, following the unfolding process performed, using MAXED and GRAVEL codes, important dosimetric quantities such as: the total fluence rate, the ambient dose equivalent, the mean energy and the spectrum averaged fluence-to-dose equivalent conversion were evaluated for the final neutron spectrum.

Overall, it reveals that the unfolded spectra derived by MAXED or GRAVEL, using the default spectra obtained from WinBUGS, are very encouraging and similar compared to those obtained by the same codes using the Monte Carlo default spectrum calculated by MCNP5.

P073: THE UV- VISIBLE - IR EMISSION OF RARE GASES IN DIELECTRIC BARRIER DISCHARGE

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Abstract

The excitation of rare gases by dielectric barrier discharge provides an efficient arrangement for the generation of radiation in the UV visible and IR. Excimer lamps, excited by this method, have recently received much attention for medical and industrial applications. This work is a theoretical and experimental investigation of the electrical and kinetic properties of a dielectric barrier discharge in krypton. The experimental work was carried out in the Laboratory Diagnostics of Plasmas Out of Equilibrium (Albi-France) DPHE realized for different operating conditions (pressure, voltage and frequency) based on an experimental device, composed of a dielectric barrier lamp filled with Krypton. The discharge is established by the application of a high voltage between two electrodes placed on either side of an insulating plate. The aim is to characterize the electrical and optical properties of a krypton lamp whose reference configuration was developed by the Saint Gobain Research Group. The optical part is acquired using an OCEAN OPTICS USB4000 spectrometer (177nm-890nm). The electrical part voltage and current is acquired in parallel. The characteristic and optimal parameters of operation have thus been determined. Characterization involves a spectroscopic study of the light emission of the discharge under different experimental conditions. The optical emission spectroscopy (OES) technique applied to the DBD Kr allowed us to identify the characteristic lines of this discharge in the visible and infrared range. Thus a study of the atomic spectroscopy of this gas to identify the excited atoms and molecules responsible for different emission ratios is carried out. The optimization study explored the various parameters of influence such as pressure, applied voltage and frequency on the electrical and optical behavior of the discharge. The objective is to improve the emission performance of this lamp.

P074: ASSESSMENT OF VARIATION OF CESIUM-137 IN CULTIVATED FIELD FOR SOIL EROSION ESTIMATION

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Abstract

A new study of Cs-137 distribution in cultivated soil was carried out at the Fergoug watershed, wilaya of Mascara for spatial quantification of soil loss for a soil conservation strategy. Forty-six (46) samples were taken from the experimental site at the transect with a slope of about 18% along the direction of cultivation. The samples collected by using a motorized corer at a depth of 70 cm. Six (06) other samples were taken from the surface.

In the laboratory samples were dried, sieved with diameters <2 mm conditioned and The preparation of soil samples required drying, crushing and sieving to finally lower than 2mm diameter. The sample analysis was analyzed by gamma spectrometry technique composed with a high resolution HPGe detector with 1.8 keV to ^{60}Co 1332.5 keV line. The spectrums treatment was carried out using the Genie 2000 software dedicated to the processing of gamma spectra. The quantification of radiotracers such as cesium-137 required calibration of the gamma spectrometry chain in terms of energy and efficiency.

The specific Cs-137 activities obtained are then converted by applying the proportional model and the mass balance model for the quantification of erosion and accumulation points.

The results obtained show that on our site there are two erosion zones and one sedimentation zone. The estimated rate of erosion rate was estimated using the conversion models such as: the proportional model and the mass balance model to specify the limits and benefits of each model. A comparison was made between the two models in order to choose the most real model.

Keywords: *Fergoug site, Cs-137, Gamma spectrometry, Conversion models, Erosion rate.*

P075: AL, SI, FE AND CU K X-RAY PRODUCTION CROSS SECTIONS FOR ALPHA BOMBARDMENT

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Abstract

Particle induced X-ray emission (PIXE) has now become a well established technique for multielemental analysis of both thick and thin targets. The K-shell production cross sections represent the database of primary importance; they are not only used routinely in PIXE application but they also provide a calibration standard for cross section measurements of other shell. We present in this contribution semi-empirical K-shell production cross section for elements Al, Si, Fe and Cu by alpha particle in the range 5-15 MeV. Within the individual treatment of these elements, the experimental databases are normalized to their corresponding values of the ECPSSR model to deduce the semi-empirical cross sections. These databases rely on the different compilations available in the literature. Finally, a comparison is made with the ECPSSR predictions and the empirical results of other authors.

Keywords: *PIXE, K x-ray production cross section; PWBA and ECPSSR model; semi-empirical cross sections.*

P076: CHARACTERIZATION OF SOLID CATALYSTS BY X-RAY DIFFRACTION

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Abstract

X-ray diffraction has acted as the cornerstone of twentieth century science. Its development has catalyzed the developments of all of the rest of solid state science and much of our understanding of chemical bonding. This work presents the necessary background to understand the applications of X ray analysis to solid catalysts; Iron and copper exchanged ZSM-5 zeolite catalysts has been prepared following several strategies of synthesis. Cu-ZSM-5 and Fe-ZSM5 were characterized by powder X-ray diffraction and X-rays fluorescence technique. The cell parameters calculated from the crystallographic data, showed that the structure was slightly modified. Such changes can be explained by the penetration of the ion $Cu^{2+}$and Fe^{3+} in the framework zeolite, the chemical compositions of the unit cells of the Fe-ZSM-5 ($Fe_{3.51}K_{0.06}Na_{0.2}$ ($Al_{1.47}Si_{44.4}O_{50.5}$)) and that of Cu-ZSM-5 ($Cu_1K_{0.532}Na_{0.24}(Al_{1.3}Si_{44.5}O_{52.3})$) were determined by X-ray fluorescence.

P077: DEPTH PROFILE OF GALLIUM IN SI_3N_4 ET SIO_2

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Abstract

The design of new materials for environmental and energy applications requires an accurate control of their conception processes and a full knowledge of their physcial and chemical properties. Low dimensional materials such as nano-objetcs, attract growing interest for advanced application purpose, where they get increasingly involved. Among these objects, the (Si_3N_4, SiO_2) materials are widely used in the field of photovoltaics.

The aim of our study is to probe the impact of ionic implantation in these dielectric matrixes (Si_3N_4, SiO_2) on their chemical and physical properties.

The ionic implantations have been carried out using a high fluency of metallic or non-metallic ions, namely, Gallium and Nitrogen, above their solubility limit, in order to trigger the formation of GaN nanoparticles.

The ionic implantations have been realized at room temperature using the ion beam accelerator Eaton 200-20 A. The experimental conditions of implantation were chosen in such a way that the implantation profiles overlap, in order to optimize the probability of formation of GaN nanoparticles in the silicon nitride (SiN_x) matrix. The silicon oxide SiO_2 and silicon nitride Si_3N_4 samples have been implanted with:

- Gallium (^{69}Ga) using a $5*10^{16}$ atoms/cm² fluency at 70 keV, energy.
- And then implanted again with nitrogen (^{14}N) using a $6*10^{16}$ atomes/cm² fluency at 35 keV, energy.

Several heat treatments at 1100°C, under gaseous flux of nitrogen (2 ℓ/min), were carried out, with different durations. This work focuses on the study of the ionic diffusion of the implanted ions, within the aforementioned matrixes, depending on the length of the heat treatments at 1100°C.

To this aim, several ions beam techniques were used to characterize our samples, namely, RBS and NRA, in order to determine:

- Thicknesses,
- Samples stoichiometry,
- And chemical profiles of the implanted ions (Ga) within the thin (SiNx) targets.

We have developed a code inspired from the D. Shakhvorostov works (NIMB 272 (2012)18), for the extraction of the profile of implantation from the backscattering spectra. This allowed us to study the diffusion of the gallium under the conditions of annealing

TOPIC 4: NUCLEAR REACTOR PHYSICS

P078: STUDY ON RADIONUCLIDE I-131 RELEASED AS A RESULT OF A NUCLEAR ACCIDENT AND ITS EFFECTS ON HUMAN HEALTH AND THE ENVIRONMENT

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Abstract

Under severe accidental conditions with partial or total damage of the core, a significant fraction of the reactor core inventory called "source term" can be released in the atmosphere. The dominant radionuclides constituting the source term include noble gases (Xe, Kr), volatile (I, Cs, Te) and semi-volatile (Sr, Ba, Rh, Ru) groups. I-131 as a product of nuclear fission, can be inhaled, or absorbed through the skin. External exposure to large amounts of I-131 can cause burns to the eyes and on the skin. Internal exposure can affect the thyroid gland. The thyroid gland uses iodine to produce thyroid hormones and cannot distinguish between radioactive iodine and stable (non radioactive) iodine. In this work, we assess the dose of I-131 that can be absorbed by people near the hypothetical accident site and the impact on their health and on the environment in general using specialized programs for this purpose. The calculated doses of I-131 could particularly contribute to help for the elaboration of the emergency plan in order to assure the protection of the personnel, the inhabitants in the vicinity of the nuclear site and the environment.

P079: NUCLEAR DATA UNCERTAINTY PROPAGATION TO REACTIVITY RESPONSES OF NUR RESEARCH REACTOR: APPLICATION ON IV.N CONFIGURATION

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Abstract

High accuracy in physic parameters makes reactor operating efficient and safe. Assessing the nuclear data uncertainties propagation on integral parameters such as k-eff or reactivity response is more and more required for nuclear reactor model. Sensitivity and uncertainty analysis has been performed for NUR research reactor. This method is based on the adjoint sensitivity analysis using TSAR (Tool for Sensitivity Analysis of Reactivity Responses) of SCALE package.

Two states of a reactor system in the IV.N configuration with different temperatures hot and cold were considered. A TSAR uses computed sensitivity coefficients for the k-eigenvalues at the two states of a reactor system and combines them to obtain sensitivity coefficients for the difference. For each state, the k-eigenvalue sensitivities have been previously calculated using the TSUNAMI-3D control sequences in SCALE. TSAR combines the reactivity sensitivity coefficients with nuclear data covariance information to determine the uncertainty in the reactivity response. The results are used to determine important data sensitivities which make the largest contributions to the sensitivity and uncertainties in reactivity response.

P080: COMPARISON STUDY BETWEEN TWO METHODS FOR CALCULATION OF ATMOSPHERIC DISPERSION

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Abstract

The monitoring of pollutant's emissions in the atmosphere constitutes for the industrialists a main environmental issue. That they are punctual (emissions of pollutants by a chimney) or fugitive (accidental releases of drains or storages), the knowledge and the control of these emissions are important data to quantify and reduce their environmental impact. In this context, the modeling of atmospheric dispersion is an interesting tool of analysis for the monitoring of a site and this paper has permitted the creation of an operational computer code ensuring the follow-up of pollutants on an industrial or nuclear (I/N) site.

We have developed a new model to calculate the emissions generated by the chimneys (point sources) and the dispersion of these emissions in the surrounding area of the I/N site.

This model is based by the Gaussian model which is a standard approach for studying the transport of airborne contaminants due to advection by the wind.

Results obtained by this model are presented under various annual parameters as; wind, wind direction, stabilities, gas flow and geometrical characteristics of chimney.

Keywords:*Dispersion, site, Gaussian model, wind, wind direction, stabilities, chimney gas flow, height of chimney.*

P081: PROBABILISTIC METHODS BASED FAULT TREES ANALYSIS FOR NUCLEAR SAFETY ASSESSMENT

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Abstract

In order to better master nuclear safety, reliability characteristicsrelated to safetyhave been subjects of special consideration.As a consequence, probabilistic methods were developed to accommodate to the special features of nuclear safety problems.This paper deals with the reliability and safety analysis and assessment of benchmark safety systems. For doing so, probabilistic safety analysis (PSA) method is proposed and developed namely the fault tree analysis (FTA) method. The FTA method is performed using RiskspectrumPSA® software. The safety and the reliability of benchmark safety systems are analyzed and enhanced considering various cases of standby redundancy systems. The quantitative FTA provides the failure probability of the top event. However, the qualitative FTA provides the minimum cut set (MCS). The proposed method is validated through the comparison of their results based on a set of factors that are of varying importance depending on the specific factors of each case. Furthermore, the safety and reliability of the benchmark safety systems are clearly enhanced using standby redundancy.

P082: CONVERGENCE ASSESSMENT OF THE MCNP5 MODEL FOR NUR RESEARCH REACTOR

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Abstract

In recent years, the Monte Caro (MC) methods have become a reference tool for criticality calculations. Despite the high precision reached in MC modeling, the criticality calculations are still faced with the fission source convergence problem leading, thereby, in some cases to incorrect results.

Consequently, to prevent from these specific issues, a convergence assessment has been carried out, in this work, for MC model of the NUR research reactor initial core.

To this end, the effective multiplication factor k_{eff}, and the Shannon entropy of the fission source, H_{src}, were evaluated for various M, the number of neutrons per cycle, and for different positions of the initial fission source in the reactor core. From the obtained results, it reveals that: a number of 10000 or more neutrons/cycles were needed to reduce bias on k_{eff} and at least 30 inactive cycles are required to allow k_{eff} convergence. Whereas, the choice of a point source in each fuel element or in each fuel plate are the preferred assumptions. As for, the number of active cycles it can be fixed according to the reasonable uncertainty that a user may accept for the effective multiplication factor, k_{eff}.

Keywords: *Monte Carlo, k_{eff}, Source convergence, Shannon entropy.*

P083: THERMAL EFFECT ON THE REACTIVITY OF OKLO NATURAL NUCLEAR REACTORS, MONTE CARLO SIMULATION

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Abstract

The Oklo phenomenon discovered in a 2 billion years old uranium deposit remains a scientific mystery for 45 years since its discovery. A complete understanding of this phenomenon needs to associate neutron physics with geological statements. The occurrence of criticality of the Oklo reaction zones has been explained in previous works (NAUDET 1991, BENTRIDI 2011), but the functioning and operating of such systems in nature, needs also to study the effect of temperature on the criticality evolution. The observation in-situ stated that the fifteen reaction zones discovered in Oklo deposit were located at different depths, which makes the temperature and pressure change from one zone to another. This will imply a variation of the fluid density under those both parameters with taking into account the geological context.The effect of temperature is studied in the present work, by numerical simulation carried out with the widely used code MCNP for a homogenous spherical core, to obtain the multiplication factor K_{eff}, implying reactivity ρ. It was possible to define some thermal effects contributions as a variation of pcm/°C.

P084: MODEL OF NEUTRON DOSIMETER FOR CRITICALITY ACCIDENT SITUATIONS

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Abstract

Neutron dosimetry in the case of criticality accidents is complex. In this work we proposed a model of neutron dosimeter capable of measuring neutron kerma on the surface of the body of the person accidentally exposed to high doses of radiation. The dosimeter contains set of activation detectors with following reactions: $^{63}Cu(n,\gamma)$, $^{103}Rh(N,INL))$ and $^{199}Hg(N,INL)$ et $^{56}Fe(n,p))$, and an albedo dosimeter. The dosimeter must give information on the neutron spectrum as well on the total absorbed dose. The Monte Carlo Code MCNP5 was used to study the albedo dosimeter response to the most likely neutron spectra during accidental exposure. The simulation is carried out according to the method recommended by ISO. A TLD dosimeter was proposed for measuring gamma dose.

Keywords: *Neutron dosimetry, criticality accident , kerma , activation detectors , albedo, MCNP5.*

P085: STUDY OF TRANSMUTATION RATE OF LONG LIVED FISSION PRODUCT: IODINE-129

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Abstract

Transmutation is the transformation of one chemical element into another by a modification of the atomic nucleus of the element. This technique is used in accelerators and nuclear reactors, particularly for long-lived nuclear waste. Iodine 129 is a nuclear waste that has a lifetime of 15.10E6 years. The transmutation is done after a separation and preparation of the targets to irradiate them. In this study the calculations of transmutation rate with ChainSolver codeare defined for high neutron fluxes in BR2 high flux reactor. These results are compared with the experimental results and the results calculated by Calculation codes such as SCALE and MCNP.

P086: MONTE-CARLO OPTIMIZATION OF A CHANNEL NEUTRON-BEAM USE FOR NEUTRON DIFFRACTION

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Abstract

The installation of neutron diffraction technique for several applications such as liquids and amorphous, crystal structure, strain analysis, or magnetic characterization of materials requires the full establishment of the energetic neutron flux distribution at the exit of the considered nuclear reactor channel. Monte-Carlo simulation is useful tool for the outgoing neutron beam characterization and the diffraction tests on many samples of different nature.

Our study aims to optimize the exploitation of the horizontal channel H4 of the Es-Salam research reactor for multiple neutron diffraction analysis using different resolution conditions according to the wave length-flux distribution and the characteristic parameters of each characterization. The obtained results permit the establishment of the possible upgrading conditions of our neutron diffractometer for materials study.

P087: SCATTERING EFFECT OPTIMIZATION IN NEUTRON IMAGING BY SCALE SIMULATION

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Abstract

Monte-Carlo simulation is useful tool for neutron transmission characterization and neutron attenuation data analysis in neutron imaging. In experiment, secondary effects affect the measurement data and consequently the interpretation. Good quantification of the obtained transmission data requires the consideration of these effects and the associated statistical errors generated in the obtained images.

The present work aims to optimize the experimental conditions by using the SCALE code to minimize the scattering effect contribution in the neutron transmission data in order to obtain good image quality. We have applied this concept on several materials with different neutron attenuation coefficient. The obtained results for

Al, Fe, Mo, Mn and Pd have permitted to get the required threshold distance for the good determination of the neutron attenuation characteristics of these materials.

P088: CALCULATION OF NEUTRONIC PARAMETERS FROM ISOTOPIC ANALYSES OF OKLO SPENT FUEL SAMPLES (RZ2)

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Abstract

The Oklo nuclear reactors in Gabon, ignited naturally two billion years ago, were discovered in June 1972. Since this day, some fifteen of reaction zones (RZ) were located. The operating of these reactors produces radioactive elements similar to those found in irradiated fuel. The aim of this work is to calculate the neutron parameters of the Oklo reactors using isotopic and chemical analyses of the fission products, essentially the rare earths elements.

The Oklo natural nuclear reactors present a real case of long-life operating nuclear system induced by a thermal neutron flux. Besides that, it presents also natural analog of nuclear waste geological storage. That what permit to scientists today to discover the traces and signature of 2 billion years old, fission nuclear reactors. The main explanation of such phenomenon was the signature of fission rate given by chemical and isotopic analyses of samples provided from the uranium deposit were the U235 anomaly was detected.

It is possible with some simple equations to define a mathematical model to determine some neutronic parameters, like fluence, spectra index, conversion factor, age of reactions and reaction duration, by the use of isotopic analyses of depleted uranium and fission products as it was done by RUFFENACH.

Mainly, the stable fission products with some features like capture section, rate fission and abundance, may give us a very useful information about the operating of Oklo reactors.

Accuracy of such calculations is based on the calculation of neutron effective cross section under temperature conditions equivalent to the Oklo case.

P089: ESTABLISHMENT OF THE REFERENCE LEVEL OF RADIOACTIVITY AROUND NUCLEAR INSTALLATIONS

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Abstract

The main objective of this work is to characterize the different compartments of the environment, by considering air, soil and fresh water samples, in order to establish a reference level of natural and artificial radioactivity. Thus, soil samples were collected from different undisturbed areas in Nuclear Research Center of Draria (CRND). Samples were collected, conditioned and analyzed by direct counting by gamma spectrometry in the Environmental Laboratory of Nuclear Research Center of Algiers (CRNA). The results clearly show the presence of a normal rate of natural radionuclide in soil samples. As for artificial radioactivity, it is represented by trace amounts of ^{137}Cs in the soil, resulting likely from the nuclear weapons tests or nuclear accidents, such as Tchernobyl.

Keywords: *Radioactivity, ^{137}Cs, Air, Soil, water, gamma spectrometry.*

P090: SPHERICAL FUEL FOR HIGH TEMPERATURE NUCLEAR REACTORS; THERMAL HYDRAULIC ANALYSIS

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Abstract

High temperature gas nuclear reactors of GEN III and GEN IV use spherical fuels. Understanding the behavior of these spherical fuels allows safe operation of the nuclear reactor. In this work, a spherical fuel such as those used in PBMR or HTR-PM nuclear reactors, is studied. The calculations are carried out for a gas flowing around the spherical fuel. Four inert gases, namely air, helium, carbon dioxide and nitrogen are investigated in three dimensions of space. The equation set-up is based on the resolution of the conservation equations of mass, momentum and energy. The k-omega turbulence model is used for the evaluation of turbulent viscosity. The main results obtained deal with the evolution of the pressure and the shear stresses around the fuel sphere as well as the evolution of the Nusselt number and the surface heat transfer coefficient. From the obtained results, one can see that the greatest rate of heat transferred from the spherical fuel is the one when helium is used. Following this, a parametric study is made to know the optimum gas velocity to use safely. This study shows also that the other three gases can also be used even in emergency situations, as the melting temperature of clad is never reached

P091: 3D STUDY OF THE DIRECTION OF GAS RELEASES FROM THE NUCLEAR SITE OF DRARIA

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Abstract

The simulation of the dispersion phenomenon of gas releases from the nuclear site of Draria in air is done, in three dimensions of space, using CFD (Computational Fluid Dynamics) calculations. The mesh of the Draria nuclear site is carried out by GAMBIT and the resolution of the conservation equations of mass, momentum, energy and species was done using the finite volume method implemented in the simulation code FLUENT. The study is conducted by the location of a fictitious chimney near the nuclear reactor building from which the gas release is made. The gas release is studied for several chimney heights. To obtain satisfactory results, the sensitivity to the mesh is studied and presented. For all these gas release heights, the dispersion of the gas release over the whole site is calculated as well as the different concentrations depending on the distance traveled by the gas. To account for the density of the gas released, four gases of different densities are used. All the results of the 3D simulations are presented and commented. The obtained results allow to understand and to follow the gas direction, the height of its starting point, its propagation in a radius close to its starting point and the direction it will take all around the buildings of the nuclear site.

P092: PHOTON NEUTRONS SOURCE EVALUATION IN HEAVY WATER RESEARCH REACTOR

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Abstract

This work consists to determine photoneutrons intensity in the heavy water research reactor after a long shutdown (up to one year). The photoneutrons source is useful to start up the reactor without external source. We

know that for heavy water reactor, the origin of Photoneutrons is due to nuclear reaction between gamma rays from the precursors and Deuterium. First, is suitable to evaluate the gamma rays intensity and then, estimate their reaction rate in heavy water which is proportional to Photoneutrons intensity. The gamma rays intensity is determined by SCALE code with ORIGEN-ARP module and the nuclear cross section $^{2}D(\gamma, n)^{1}H$ is taken from AIEA data base. It is important to precise that the data library for heavy water reactor assembly used in ORIGEN-ARP is obtained by TRITON-ARPLIB modules (Cross Section is function of burnup from 0 to 10000MWD/TU). For the first start up of heavy water research reactor, generally Am-Be source with intensity 1.23E+06n/s is used. The value of the intensity of photoneutrons source obtained is about 1.22E+06n/s. As we see, this value is in the same order than that of Am-Be source. Then, we can conclude that, after a long shut down (900 days), it is possible to run the heavy water research reactor without external source.

Keywords: *ORIGEN-ARP, TRITON-ARPLIB, Photoneutrons, SCALE*

P093: STUDY OF DYNAMIC CHAOS IN NUCLEAR REACTOR WITH COUPLED TWO TEMPERATURE REGIONS AND DISCRETE REGULATION SYSTEMS

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Abstract

The problem of the stability of a nuclear reactor by a discrete regulation system was investigated within the framework of the point model and a single temperature for slow processes that are by far more useful for all nuclear reactor control problems. In this case, the mathematical equations may be considered as linearized and the inertia of the fast feedbacks and the lifetimes of the prompt and delayed neutrons can be neglected.

The existence of a discrete regulation system in a reactor is inherent nonlinear which result in self-excited oscillations of the neutron density and other parameters. Postnikov studied the dynamic of the a nuclear reactor with the regulatory systems and demonstrated the appearance of dynamic chaos in a reactor by positive single feedback temperature in a boiling water reactor [1].

In the present work we determine and investigate new cases of the appearance of chaos for more complicated feedback for two coupled regions of temperature with the nonlinear control algorithms with slow processes stabilization. It is shown that, even in this case, the stochastic oscillation can arise.

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P094: DYNAMICS OF OKLO NATURAL REACTORS

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Abstract

The Oklo phenomenon discovered in a 2 billion years old uranium deposit remains a scientific mystery for 45 years since its discovery. A complete understanding of this phenomenon needs to associate neutron physics with geological statements. The occurrence of criticality of the Oklo reaction zones has been explained in previous works (NAUDET 1991, BENTRIDI 2011) but the questioning about how did those systems operate and evolve in their geological environment. The exploitation of Gabon's uranium mines in the 1970s led to the discovery of fifteen natural nuclear reactors. These reactors diverged spontaneously 1.950 billion years ago and have operated from a few tens of thousands of years to a few hundred thousand years for the longest ones before definitive shutdown. Traces of these reactors as well as the presence of stable descendants of fission products and activation products have led to many studies in terms of reactor-physics and migration of radioactive elements in nature.

Some of them even studied these sites as natural analog of nuclear waste deposit. The mystery of the start-up of these reactors was only solved a few years ago thanks to modern neutron modeling tools.

After an introduction on what is known about natural Oklo reactors, this first part of the talk will be dedicated to the explanation of the Oklo phenomenon, both for the geological aspects as for the aspects of physics and neutronics.

TOPIC 5: RADIATION IN MEDICINE

P095: COMPARISON OF TWO FULL FIELD DIGITALMAMMOGRAPHY SYSTEMS:IMAGE QUALITY AND RADIATION DOSE

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Abstract

Full field digital mammography (FFDM) has been progressively introduced in medical centers in recent years.

The goal of this study was to compare the average glandular doses (AGD) and image quality of two FFDM systems namely IMS Giotto and General Electric Senographe Essential.

The AGD was calculated according to Dance et al by using the measured entrance surface kerma, acquisition parameters and c,g,s factors.

The image quality was assessed quantitatively by measuring the contrast to noise ratio (CNR) value using a PMMA homogenous phantom of 2, 4, 6 ad 8 cm thicknesses and a small contrast object (foil of 0.2 mm Al)Following the European protocol.

The obtained values were used to calculate the Figure of Merit (FOM).

Measures analysis showed that there is a significant difference value of AGD and CNR for thicknesses greater than 4 between the two FFDM systems.

A comparison of the CNR values in this study meets those recommended in the European protocol.

GE Senographe Essential system contributed the highest AGD value while IMS Giotto had the highest CNR and FOM value.

P096: COMPARISON AND VALIDATION OF DOSE DISTRIBUTION IN THORAX PHANTOM USING GATE V7/GATE V6

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Abstract;

In conformational radiotherapy, the estimation of the absorbed dose to tumors and healthy tissues is a tool for evaluating and optimizing treatment.

Dosimetry for photon beam used in external radiotherapy cannot be performed analytically without restrictive approximations, Techniques Monte Carlo are an alternative.

Gate (http://opengatecollaboration .org) is a Monte Carlo simulation platform based on the GEANT4 code dedicated to SPECT/TEP applications and radiotherapy/brachytherapy, Geant4 and Gate, through the fGATE project, are currently being validated for dosimetry applications

The purpose of this work is to compare and validate gate version 6.1 and gate version 7.2 for radiotherapy using photon beams of 6 Mv of a Varian TrueBeam STX accelerator in realistic clinical conditions

A 6 MV Photon beam derived from a Varian TrueBeam STX accelerator was modeled with Gate 6.1 and gate 7.2 codes. In the first part, the modeling of the accelerator was validated by comparison of dose profiles and PDD (percentage depth dose) simulated and measured in homogeneous water phantom. For the second part; is to validate and compare the two gate versions by dose distribution in a Thorax phantom

The comparison of the dose profiles and PDD simulated with that measured shows a good agreement. Furthermore Gate 7.2 allows the calculation of dose distribution with the same level of accuracy

P097: DOSE ASSESSMENT IN 2D AND 3D MAMMOGRAPHY

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Abstract

Mammography remains the gold standard for screening for breast cancer. In Algeria, Many medical imaging departments are presently moving to the digital modalities. However, digital mammography CR, DR and tomosynthesis are now available, allowing the radiologist to capture and manipulate the images so abnormalities can be seen more easily. Breast dosimetry is an important part of quality assurance program and an essential tool to optimize breast imaging procedures.

The aim of this study is to compare two techniques 2D and 3D imaging using a specific metric called 'Average Glandular dose (AGD)' in mGy. Direct measurements on 32 patients were carried on in the public hospital CHU Beni-Messous with digital mammographic system 'Giotto tomo-IMS' including right and left craniocaudal (CC) and mediolateral oblic (MLO) views.

Patient related data are represented by the range [min-max], average, median value and standard deviation of the measurements in the 2D and 3D modalities. The relative discrepancy between AGD (2D) and AGD (3D) was 55%.

A particular attention must be accorded to the optimization of patient doses in mammography due to the latest recommendations formulated in ICRP103.

Keywords: Breast dosimetry, Average glandular dose, Mammography, Tomosynthesis.

P098: EFFECT OF ENERGY SPECTRUM ON REFERENCE KERMA RATE CALCULATION FOR SEALED SOURCES USED IN RADIOTHERAPY

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Abstract

For brachytherapy applications, the process of setting up the treatment involves several steps including reference kerma rate calculation using a treatment planning system.

Generally for calculations, the simplest and most frequent is the use of the weighted average energy of the radioelement. The aim of this work is the study of the effect of the energy spectrum on the reference kerma rate around the sealed sources used in brachytherapy.

The sources chosen for this study are a grain of Cs137 type CDC1100, a wire of IR192 type IRF2 used in low dose rate brachytherapy and a grain of Co60 type Ao086 used in high dose rate brachytherapy. The spectra used are the reference spectra extracted from the Radioisotopes data table (RITD). A comparison is made between the kerma rate calculated using the weighted average energy and the total spectrum. The results of this study show a difference of 6.28%, 4.25% and 0.05% for Cs137 Ir192 and Co60 source's respectively. For these comparisons, and for a better estimate of the reference kerma rate, we must take into account the energy spectrum of the radioelement.

P099: REFERENCE KERMA RATE EVALUATION USING SIEVERT INTEGRAL FOR EXTENDED SOURCE

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Abstract

For dose determination in brachytherapy, the calculation requires a good knowledge of the geometrical and physical characteristics of sealed sources, as well as the composition of medium in which it is implanted.

Various models of dose calculation are proposed and used in practice. The present work aims to perform an analytical calculation of the reference kerma rate (apparent activity) using Sievert integral in the case of filtered extended source rather than the isotropic source hypothesis. The Sievert integrals are available in tabulated forms, as they can also be solved using numerical methods.

In conclusion, it can be said that the Sievert integral which supposes that the energy fluency emitted by the primary photons is attenuated exponentially inside the capsule thickness, it concerns the calculation of the dose distributions at two-dimensional and neglects the contribution of the scattered radiation in considered biological medium. Furthermore, it considers one source with zero diameters. This will not take into account the directional effect of the radiation coming from the source. Hence, it is important to introduce new dose calculation formalisms in order to take into consideration the real form of the source and medium composition.

P100: DOSE DISTRIBUTION OF THE CURVED RADIOACTIVE SOURCE HDR-^{60}CO IN WATER

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Abstract

We developed a program with the MATLAB code to calculate the dose distribution around curved radioactive source of 60Co. The program calculates the dose distribution in two dimensions and the curved source is equivalent to the seed of 60Co on the applicator with the technique of pulsed dose.

We have simulate the dose distribution in water from a seed source of 60Co in an cylindrical geometry with the code MC “EGSnrc” and calculate the dose by using the superposition method, with this two component (MC simulation and superposition technique). A comparison of dose distribution with other work like “the algorithm sagiplan” was made; the difference between the two methods is within 1-2% on the region form 1cm up to 15cm from the curved source and 10-15% near the source. In the later case this difference is due to the high gradient of dose near the source according to the distance.

Keywords: *Monte Carlo code EGSnrc and the superposition method.*

P101: STUDY OF VACCINATION OF MICE WITH GAMMA (Γ)-ATTENUATED PROTOSCOLEX

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Abstract

Cystic hydatid disease is caused by the larval stages of the cestode and affects humans and domestic animals worldwide. Protoscoleces are one component of the larval stages that can interact with both definitive and intermediate hosts. The principal investigation of this study had been undertaken to assess the potential role of using a radio-attenuated form of these protoscoleces as a prophylaxis agent, by finding out its effectiveness for developing a protective immunity in a murine model against hydatid disease.

Mice were immunized with gamma (γ)-irradiated protoscoleces. A second immunization was given after 15 days of first immunization. After two immunizations, mice were infected with intact protoscoleces. Protection against hydatidosis was evaluated by a macroscopic study of the development of the cysts in the target organs as well as by a histological examination performed on the liver.

It was observed that mice having prior immunization with radio-attenuated parasites showed protection against the challenge dose through a decrease in the number and diameter of the cysts as well as the changes and structural damage observed at the microscopic scale.

The vaccination using protoscoleces radio-attenuated appeared effective in terms of the incidence rate of disease and the resulting immunoprotection.

P102: THEORETICAL STUDIES OF STRUCTURES AND STABILITY OF TECHNETIUM AND RHENIUM-TRICARBONYL COMPLEXES

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Abstract

Radiopharmaceutical chemicals are routinely used in nuclear medicine for both diagnostic and therapeutic purposes [1–3]. Currently, 99mTc is the radionuclide most commonly employed in radiopharmacy due to its nuclear properties, availability, and low cost [1–5]. 99mTc radiopharmaceuticals account for nearly 80 % of diagnostic studies in nuclear medicine.

These agents are available to image almost all important organs of the body. On the other hand, 186/188Re are considered useful radionuclides for targeted radiotherapy applications

[1, 5]. In this work, a computational study of different tricarbonyl complexes of Re(I) and Tc(I) was performed using density functional theory. The solvent effect was simulated using the polarizable continuum model. The effect of the nature of the substituted group on the phenyl pendant arm (X = NO2, CF3, or Cl) on complex stability was studied. Additionally, the influences of the bridge length [furan, thiophene, pyrole) were also evaluated. Moreover, a comparison of the relative stabilities of Tc and Re complexes was carried out. The calculations were performed using the Gaussian 2016 program package.

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P103: CHARACTERIZATION OF A SCINTILLATING FIBER AND SILICON PHOTOMULTIPLIER DETECTOR FOR IN-VIVO DOSIMETRY FOR BRAQUITHERAPY

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Abstract

In vivo dosimetry has been used in brachytherapy for decades with a number of different detectors and measurement technologies. These detectors, despite of their advantages, have limitations for their clinical use as in-vivo dosimeters. Plastic scintillating fiber coupled with a silicon photomultiplier (SiPM) readout by an electronic chain for signal processing, possesses a number of dosimetric characteristics advantageous for in vivo dosimetry, like water equivalence, small size, real-time linear response and energy independence. The goal of the present doctoral work, developed in collaboration with the Institute of Corpuscular Physics (IFIC) of Valencia, is the design and construction of a scintillation dosimeter prototype for brachytherapy application.

The development of the scintillation dosimeter requires the precise characterization of its components: the scintillation fiber, its optical light guide and the coupled photo-sensor, a silicon photomultiplier (SiPM), which consist in a high-density matrix of photodiodes with a common output lead. Each diode is operated in a limited Geiger mode. This device is sensitive to single photons. The scintillation fiber and SiPM dosimeter fulfill all main

requirements for in-vivo dosimetry; however, silicon-based technology is sensitive to temperature. In the present work, we present the characterization of the SiPM to temperature changes in the range of clinical operation between 15 and 41 ºC, and the solution developed for the stabilization of the SiPM gain for in-vivo dose rate measurements during braquitherapy treatments. This work has been recently performed at IFIC and is essential for the development of the electronic readout of the dosimeter.

Keywords: *Dosimeter, Scintillating optical fiber, Silicon photomultiplier, Brachytherapy*

P104: THE VALIDATION OF RADCALC FOR CLINICAL USE, AN INDEPENDENT MONITOR UNIT VERIFICATION SOFTWARE

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Abstract

Based on ICRU recommendation, dosimetry systems must be capable of delivering dose to an accuracy of 5%, thus the dose calculation accuracy should be verified including by an independent monitor unit (MU) calculation software before treatment execution. This is especially relevant in 3D conformational radiotherapy as well as in complex technique such as volumetric modulated arc therapy (VMAT/RapidArc). RadCalc, a commercial software base on modified Clarckson algorithm has been developed in the purpose of performing MU calculation for complex plans. The validation of RadCalc in 3D-CRT and RapidArc technics for clinical use in Antoine Lacassagne center has been undertaken. RadCalc doses calculations have been evaluated against treatment planning systems (TPS) calculations (Isogray for 3D-CRT and Eclipse for RapidArc) and the doses measured in water equivalent solid phantom with ionization chambers.

The RadCalc computed dose for selected MU showed good agreement with doses computed by TPSs in 3D-CRT plans as well as in RapidArc inverse plans. Ionization chambers measurements agreed well with RadCalcl and TPSs. In most of the treatment plans doses calculated with RadCalc corroborate well with measured and TPSs computed ones.

P105: MONTE CARLO SIMULATION OF X-RAYS SPECTRA PRODUCED BY X-RAYS GENERATORS FOR IMPROVEMENT OF LOW ENERGY DOSIMETRY USED IN RADIOTHERAPY

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Abstract

PENENELOPE (PENetration and Energy LOss of Positrons and Electrons) is Monte Carlo code simulates a coupled electron, photon and positron particles for energy range 50eV to 1GeV in simple and composed materials.

The objective of this work is the simulation by using the Monte Carlo PENELOPE code, the X-rays spectra produced by X-rays generators used in surface radiotherapy (contactherapy), for the improvement of the low and middle energy dosimetry.

The program PENMAIN was used to simulate the production the x-rays spectra produced by the X-ray tube of the contactherapy of the Pierre and Marie Curie Center (CPMC), Algiers. Moreover, we proceed to the simulation of curves of depth dose (PDD) in PMMA (Polymethyl methacrylate) phantom.

For the validation of Monte Carlo Penelope results, we compared the characteristics of the spectra by measuring the half value layer (HVL) in aluminium with simulated spectrum.

The discrepancy obtained between experimental and simulation results are lower than 2% (tolerated value is (5%), fixed by ISO4037-1).

A second comparison between the PDD simulated and measured was carried out. The experiments showed that the maximum difference between R50 (depth corresponding to 50% of the maximum) is lower than 4%.

Based on the results obtained in this study, we conclude that the objectives were achieved, and that the Monte Carlo method is a good tool for the simulation of the electrons, positron and the photons transport applied in the radiotherapy.

***Keyword*:** PENELOPE, X-Ray generator, HVL, X-Ray spectra, PDD in PMMA, Dose distribution

P106: A NEW RECOVERY COEFFICIENT METHOD FOR PARTIAL VOLUME CORRECTION

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Abstract

Partial volume effects (PVEs) are consequences of the limited resolution of emission tomography systems and its correction has been an area of great interest in the recent years in quantitative PET imaging. One of the most famous and simple PVE correction methods is the Recovery Coefficient method (RC) based upon phantoms that incorporate hot spheres in a cold background. The aim of this study is to establish a similar model which allows us the quantification of the amount of the spill in from the background into the lesion to calculate the RCs that takes into account the amount of the spill in compensation, including hot spheres/lesions in a hot background. A NEMA body phantom was filled with a ^{18}F-FDG solution (16 KBq/cc). Six hollow spheres with internal diameters equal to 1.0, 1.3, 1.7, 2.2, 2.8 and 3.7 cm were inserted into the phantom. The six spheres were filled with ^{18}F-FDGconsidering 5:1 sphere to background activity ratios for the first acquisition on a GE Healthcare Discovery PET/CT 710. In the second acquisition, the six spheres were filled with cold solution in a hot background to quantify the spill in. Using the conventional RCs method and the proposed RCs method based on spill in quantification, we evaluate the average SUV of the hot and cold spheres and the background. The comparison between the theoretical SUV values of each sphere and the SUV corrected by the two RCs methods demonstrates that the results obtained by using a new proposed method more closely resemble the theoretical values when compared to the conventional method.

In perspective, we propose to generalize ourmethodology by determining the spill in factors using Monte Carlo simulation and to evaluate in patient data.

Keywords: *PET acquisition, Partial volume effects, Recovery Coefficients, NEMA body phantom*

P107: A STUDY TO ESTABLISH DIAGNOSTIC REFERENCE LEVELS OF ADULTS CT CHEST EXAMINATIONS IN ALGERIA

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Abstract

The significant patient dose from computed tomography (CT) examinations and the continuously increasing frequency oblige the rigorous application of "diagnostic reference levels" (DRLs) as an optimization tool.

The aim of this study is to establish diagnostic reference levels (DRLs) of CT 'Chest Examination'. The survey was carried out in 6 sites with 9 CT scans machines. The dosimetric quantities recorded were the Dose Length Product (DLP) in mGy*cm and the Volumetric CT Dose Index ($CTDI_{vol}$) in mGy.

The value of the NRD was determined from the 75th percentile of the mean distribution of the data collected for chest examinations of 180 patients. Mean values for each site were also calculated, and the 75th percentile of DLP and $CTDI_{vol}$ was used as a basis to establish DRLs. The rounded third-quartile of $CTDI_{vol}$ and DLP were 16.9 mGy and 522 mGy*cm, respectively. There is a significant variation in term of doses between CT departments

also with identical scanners. In some departments, the 75th percentile of DLP and $CTDI_{vol}$ are lower than those published in the literature but higher in other centers.

This work will be generalized to others sites in order to have a global and real image of the practice in Algeria.

P108: THE RADIOPROTECTION MANAGEMENT OF A PET DEPARTMENT WITH A CYCLOTRON AND RADIOPHARMACY LABORATORY, IN ACCORDANCE WITH ALGERIAN REGULATION

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Abstract

The possibility of setting up a positron emission tomography (PET) facility with a cyclotron and radiopharmaceutical laboratory in situ, at a feasible price and in a very restricted space, has led to a steady increase both in the use of the PET technique in diagnostic clinical routine imaging and in the number of cyclotrons for drug production. Owing to the progress made in the PET procedures, it is now possible to have not only a highly innovative system of diagnostic examination, with a remarkable improvement in the diagnostic quality and patient care, but also a considerable increase in the number of daily examinations.

This paper refers to the acquired know-how with respect to radioprotection in the planning, design, setting up and management of the PET/CT tomography unit, the cyclotron and radio-pharmacy laboratory, installed in the Radiotherapy and Molecular Imaging Department of Hôpital Chahids Mahmoudi, Tizi Ouzou. The unit is composed of an unshielded 16-MeV energy cyclotron; two radiopharmacy two cells on QC laboratory and one PET/CT systems. Specifically, the authors analyze the safety problems connected to the production and the utilization of ^{18}F, e.g. [^{18}F(FDG)], which at the moment is the most largely used radioisotope.

P109: VMAT QA AND DOSIMETRY: DID WE GET IT RIGHT?

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Abstract

Radiotherapy is evolving fast with new technologies and modalities. Today we have commercially available dynamic delivery of rotational intensity modulated treatments (VMAT). We also have systems that adjust the beam delivery according to the patients motions and soon we will also have commercial system tracking the movements of the tumor. We have also seen the incorporation of computerized tomography during treatment with equipment mounted on the linear accelerator (cone-beam CT) which have given us new possibilities of increasing the precision and accuracy of the patients position.

The challenge for medical physicists and other professionals within radiation oncology is to cope with this accelerated process of new modalities and technologies. Especially regarding new procedures for the daily work to establish a safe environment for these modalities for patients but also for staff. How will we assure that these systems will be able to deliver the accurate and precise dose distribution as planned by the treatment planning system? In short, the right dose at the right place at the right time. This paper addresses some of these issues by applying a quantitative analysis parameter to the dosimetric verification procedure.

P110: VOXELISED HUMAN PHANTOM STUDY USING GEANT4

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Abstract

Computerized phantoms are finding an increasingly important role in medical imaging research. Mainly, there are three different types of human phantoms: “stylized” phantoms, “voxelized” phantoms and “hybrid” phantoms .This study will focus on the second one.

The computational voxel phantom “**H**igh-**D**efinition **R**eference **K**orean-**M**an : HDRK-Man” was implemented into the Monte Carlo transport toolkit Geant4. The voxel model, adjusted to the Reference Korean Man, is 171 cm in height and 68 kg in weight and the voxel resolution is 1.981×1.981×2.0854 mm^3 and has an array size of 247×141×250 respectively, in the x, y and z directions [1].

It has been exposed to a mono-energetic beam of photons (120keV) and rotated at each acquisition of an angle of 1degree therefore in total we have 180 projections. The phantom model includes more than 30 organs and tissues that are required to calculate the absorbed dose during X-ray examination [2]. Material information including elemental composition and density was taken into account in the MC simulation. By using the appropriate classes, it is possible to calculate the absorbed doses for each organ.

Given the accuracy of our results, the present work can be considered as a consolidation of the continuous contribution by medical physicist as part of quality control tests and radiation protection dosimetry.

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P111: NEUTRON SPATIAL DISTRIBUTION FOR BNCT APPLICATIONS OF NUCLEAR RESEARCH REACTOR LVR-15

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Abstract

Boron neutron Capture Therapy (BNCT) is a therapeutic method of treatment for aggressive malignant tumors. Especially this method is used for brain tumor Glioblastoma Multiforme which is nowadays unfortunately still incurable. A key part of BNCT is proper determination of physical parameters of the neutron beam. This paper provides an overview of methods and results from measurement of neutron beam used for BNCT applications. An objective of this study was to determine spatial neutron distribution of epithermal neutron beam of nuclear research reactor LVR-15, Czech Republic. Experimental data for this study were collected using a special positioning device with ^{6}Li + Si detector. We also used a neutron radiography method. The resulting data from 3D neutron field measurement were compared with Monte Carlo N-Particle eXtended Transport Code (MCNPX).Together these results provide important insights into neutron spatial distribution of BNCT horizontal channel of LVR-15 which is quite homogenous in whole cross-section without any significant peaks. In summary, these results show that neutron beam (after repeating another important measurement) could be used for continuation of BNCT applications in Czech Republic.

TOPIC 6: RADIATION IN INDUSTRY, LIFE AND NATURE SCIENCES

P112: ATTENUATION COEFFICIENTS OF SOME SOIL PHYSICAL PROPERTIES

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Abstract

The mass attenuation coefficient (μ/ρ) is an important parameter to characterize the penetration and interaction of gamma-rays in the soil. Accurate determinations of μ are important to obtain representative values of soil physical properties by gamma-ray attenuation technique. In this study, the effect absorber thickness (2–5 cm) on the experimental μ values of water and soils (samples that were collected from different zones in Algeria) with different textures were investigated for different gamma-ray sources. Theoretical results were calculated using the program GEANT4 (monte carlo method is a numerical method of solving mathematical problem by random sampling). Experimental results were compared with theoretical ones showing a good correlation between methods.

Keywords: *Scintillation detector, gamma, Geant4 code, radioactive source, soil.*

P113: IMPACT OF EUV RADIATION ON DAYTIME IONIC AND ELECTRONIC PRODUCTIONS IN THE EARTH'S IONOSPHERE

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Abstract

The upper atmosphere (thermosphere and ionosphere) is constituted by different regions identified by their structure, density, composition, degree of ionization and temperature.

The temperature structure is meanly governed by the absorption of solar radiations.

Major neutral constituents of the upper atmosphere are N_2, O_2, O. All charged species present in that portion of the atmosphere are produced either directly by photoionization due to the solar EUV radiations and ionization of neutral atoms and molecules by precipitating solar wind particles, or indirectly by ionic-chemical reactions.

Based on the Boltzmann kinetic model and appropriate geophysical parameters, we present in this work the production rates of major ionospheric ions N_2^+, $O_2^+$and O^+ and the total electron production rate at high and middle latitude in the Europe- African sector longitude.

We also focused this work on the diurnal variations of the ionic and electronic productions.

Our results highlight that at middle latitude, the EUV solar radiations are completely responsible of the ionic and electronic productions. While at high latitude, we note a critical altitude approximately at 160 km, beyond which the principal source of ionization comes from the precipitation of energetic particles.

Keywords: *ionosphere, solar radiation, photoionization, production rate.*

P114: IONOSPHERIC THERMAL ELECTRON HEATING BY EXTREME ULTRAVIOLET AND SOFT X-RAYS SOLAR RADIATIONS

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Abstract

The Soft X-rays (1- 10 nm) and the Extreme Ultraviolet (10-121nm) solar radiations, responsible of the photoionization of neutral atmospheric constituents giving rise to ions and suprathermal electrons, depends on the solar activity. To characterize such activity there are myriad of parameters. The more appropriate in the UV range is the F10.7 index.

Due to a luck of measurement, semi empirical models are often used to model the intensity of a solar flux at high altitude. In this work, we use the Boltzmann model to describe the transport of suprathermal electrons in the ionosphere and the EUVAC model to quantify the intensity of the solar flux to present the heating rate of ambient ionospheric electrons by suprathermal ones and the dependence of this rate on the solar activity through the F10.7 variations. The daily variation, of this rate is also investigated. It is found that the solar activity enhances the rate of heating.

Keywords: *solar radiations, heating, ionosphere, earth environment.*

P115: STUDY OF THE EFFECT OF UV AGING OR ON THE MECHANICAL PROPERTIES OF AGEOTEXTILE BASED ON POLYPROPYLENE

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Abstract

Geo-synthetics are produced in various forms from plastics based on various polymers from the chemical and petrochemical industry. The numerous existing geo-synthetic products can be classified into four groups according to the raw material used, the method of manufacture and the field of use. These are: geotextiles, geomembranes, bentonitic geosynthetics and geocomposites.

Polypropylene is widely used for the manufacture of geo-synthetics and geotextiles, due to its mechanical properties suitable for application, combined with good resistance to most chemical and biological agents. However, this polymer has a high sensitivity to oxygen; Which can lead to chemical degradation resulting in embrittlement of the material.

The main objective of this work is to study the effect of aging by UV radiation on the physical and mechanical properties of two types of polypropylene-based non-woven geotextiles. First, a study of the physical, mechanical characteristics was carried out, followed by an aging test by ultraviolet radiation as a function of time in order to evaluate their mechanical characteristics before and after aging using standard tests a Been initiated.

The results obtained show that: the mechanical properties such as the tensile strength of a geotextile depend on its specific surface area and its thickness, so the resistance to static and pyramidal punching increases with increasing geotextile thickness. A significant loss in tensile properties (tensile strength and elongation at break of about 50% for a time of exposure of geotextiles to UV radiation for 300 h.

Finally, it can be concluded that polypropylene geotextiles are sensitive to ultraviolet radiation. Therefore, in order to increase the service life of a geotextile, it is necessary to avoid exposure to light during storage and processing, or to add a stabilizer.

P116: KINETIC STUDY AND SORPTION MECHANISM OF URANIUM VI ONTO NAY ZEOLITHE

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Abstract

Radioactive Uranium (VI) was removed by adsorption on NaY zeolithe. The sorbent was synthesized and characterized with several techniques [1]: X-ray diffraction XRD, scanning electronic microscopy MEB and Infrared spectroscopy measurements FTIR. Textural properties were determined by N2 adsorption isotherm. Batch adsorption experiments were performed to study the adsorption of uranium (VI) from aqueous solutions onNaY zeolithe material. Operating variables studied include solution pH, contact time and temperature. Equilibrium data were analyzed by the langmuir, Freundlich and dubinin-radshkovich models. The equilibrium data were best represented by the langmuir isotherm model. Sorption kinetic data were fitted using pseudo first order, pseudo second order models and intraparticule diffusion model. The experimental data fitted very well the pseudo second order model. The process mechanism was found to be complex, consisting of both mass transfer and intraparticle diffusion. The thermodynamic parameters such as standard free energyΔG_0, standard enthalpy ΔH_0 and standard entropy ΔS_0 have been determined which indicates a spontaneous exothermic adsorption process.

P117: ANALYTICAL APPROACH OF EXTREME ENERGY COSMIC RAY DETECTION FROM AN EARTH-ORBITING SATELLITE

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Abstract

Most of the Ultra High Energy Cosmic Ray (UHECR) experiments use air fluorescence to detect and measure extensive air showers (EAS). The Extreme Universe Space Observatory, on board the Japanese Experiment Module (JEM-EUSO), mounted on the International Space Station (ISS), will detect fluorescence and Cerenkov photons in the UV range 300-430 nm, generated by air showers in the Earth's atmosphere. We have performed an analytical calculation of the amount of fluorescence photons detected by this telescope for an incoming proton of 10^20 eV with a 60° zenith angle. We have improved our previous work by taking into account the transmittance of the atmosphere for this UV range.

P118: DATING BY ^{210}PB AND ^{137}CS RADIOISOTOPES OF RECENT LAKE SEDIMENTS

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Abstract

We study in the lake environments which can be considered as archives, the sediment core in order to reconstruct the history of terrigenous and anthropogenic inputs. The chronology is most often determined using some Atmospheric deposition such as the radioisotopes of ^{210}Pb and ^{137}Cs. In order to apply this method, it is assumed that the sediment core is conserved and some assumptions of deposition conditions such as sedimentation rate, radioisotopes flux and surface activity are to be respected.

In this study, dating method based on radioactive fallout of the 210Pb was performed on lake sediment cores from three lakes in France: Gerardmer, Longemer and Brevent applying the Constant Rate of Supply (CRS) Age model to determine the activity of 210Pbex (in excess), which is present only in recent sediments (whose age is less than 4 or 5 times its radioactive period, ie about 100 years). As a complementary method, the activity of 137Cs is measured, which has the advantage of providing two absolute dates (1963-1964 associated to the nuclear test period and 1986 associated to the Chernobyl accident). In order to determine the activities of the radio-elements studied, the GeHP spectrometer with a well-type detector installed in the Modane underground Laboratory (LSM) which can combine both low background and high detection efficiency and it is well suited for the analysis of small amounts of environmental samples such as the lake sediments. The ages obtained by the CRS (Constant Rate Supply) model and the ^{137}Cs dating technique are in good agreement.

The apparent sedimentation rates determined in the sedimentary records studied show great variability for the three sites.

P119: STUDIES ON NATURAL AND ANTHROPOGENIC RADIONUCLIDES IN SEDIMENT OF RHUMEL WADI (NORTHEAST ALGERIA)

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Abstract

Naturally and anthropogenic radionuclides are present in various degrees in all different geological formations in the environment. Among these formations, sediment plays an important role in aquatic radioecology, since it acts as a medium of migration for the transfer of radionuclides to the biological systems. In this study, the content of natural radionuclides (^{238}U, ^{232}Th, ^{40}K) and anthropogenic (^{137}Cs) in sediment collected from different location a long Rhumel wadi were determined using a coaxial hyper pure germanium (HPGe) detector with an aim of evaluating the radiation hazard. These results are compared with world mean values.

Keywords: *Natural and anthropogenic radionuclides, HPGe Detector; Radiation Hazards*

P120: EFFECT OF ENVIRONMENTAL PARAMETERS ONRADON CONCENTRATION AND DETERMINATION OF SEASONAL CORRECTION FACTORS

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Abstract

For the national radon map elaboration, radon measurement are generally performed in a different seasonal periods and it is important to apply a correction factor in order to represent the maximal concentration. In this study, the effects of environmental parameters have been investigatedfor the determination of these seasonal correction factors.

Behaviors of the atmospheric radon concentration using continuous measurements were carried out over more than 20 seasonal periods. More than 500 data points have been collected and the trends of diurnal and seasonal variations were analyzed. The average concentrations showed that the daily maximum appears in the early morning, and the daily minimum in the late afternoon.

Furthermore, the indoor radon concentration has found positively correlates with both the indoor temperature (r = 0.29) and the atmospheric pressure (r = 0.37) but negatively with relative humidity (r = -0.67). The annual pattern features a maximum around December and a minimum around June. Therefore, if a radon measurement has been performed in a given season, a correction factor must be applied to determine the concentration in winter

which should be considerate. Measurements show that this factor is equal to 2.5 in spring and autumn and 3.2 in summer.

P121: INCREASE IN THE ACTIVITY CONCENTRATION OF URANIUM 238 IN AGRICULTURAL SOIL BY FERTILIZATION EFFECT AND ITS ENVIRONMENTAL IMPLICATIONS

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Abstract

The gamma spectroscopy is used in this work for determining the activities of radioelements contained in fertilized soil samples. The evaluation of ^{238}U activity is based on measures around energy peaks 63.3 keV and 92.38 keV emitted by ^{234}Th which is the first product of the ^{238}U decay by radio emission. To confirm the results found, further evaluation of the activity of ^{238}U was based on measurements of emissions of its fifth descendant (^{226}Ra). In normal circumstances, the natural content of^{238}Uin sediment or soil is typically of the order of 40 Bq/kg. For the soil samples studied, while the activity of radium 226 is normal (between 40 and 53 Bq/kg), that of ^{238}U is five times higher for fertilized soils (up to 316 Bq/kg). This shows that it is an industrial source of uranium supply (fertilization effect) in soil samples and not a uranium traces accumulation contained naturally in the atmosphere.

The radiological hazards of the radium equivalent activity (Ra_{eq}), representative level index $I_{\gamma r}$, external (H_{ex}) and internal (H_{in}) indices and annual effective dose due to the presence of these radionuclides in the investigated samples were calculated.

***Keywords**: natural radioactivity, radiological hazard, soil, fertilizer.*

P122: DEGRADATION OF AQUEOUS SOLUTIONS OF IBUPROFEN USING GAMMA IRRADIATION

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Abstract

This study belongs to the investigation of an advanced oxidation process (AOP) using ionizing radiations to degrade pharmaceutical contaminants in wastewater. In fact, irradiation process of aqueous solutions involves generation of powerful oxidizing species, mainly hydroxyl radical (•OH), to destroy recalcitrant organic pollutants in water.

Anti-inflammatory drugs are the most frequently detected compounds in wastewater, especially Ibuprofen. In this purpose, Ibuprofen degradation was investigated by optimizing gamma irradiation conditions with and without addition of oxidant reactant (H_2O_2).

The considered solutions of Ibuprofen 0.1-0.8 mmol/L, were treated by application of irradiation doses from 3 to 10 kGy with 6.1 kGy/h rate. The main parameters influencing irradiation performance are absorbed doses and initial concentrations. Significant modifications attributed to these parameters appeared in the variation of degradation rate (according to UV absorbance and HPLC analysis) and chemical oxygen demand removal (COD). The concentration of radio-induced radicals of treated solutions was released using a spectrophotometer of electron paramagnetic resonance (EPR) which permitted the identification of the main radicals.

Variation curves of considered parameters versus irradiation doses described the required dose for elimination and mineralization of ibuprofen pollutant by ionizing radiation. Preliminary degradation mechanism is suggested based on sophisticated analysis using spectroscopic and chromatographic techniques.

***Keywords**: Ibuprofen, AOP, Gamma irradiation, hydroxyl radical, EPR, HPLC, COD.*

P123: STUDY OF THE PHOTO DEGRADATION OF DICLOFENAC BY POLY CHROMATIC LIGHT IN THE PRESENCE OF AN ACTIVE PHOTO MATERIAL

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Abstract

Numerous studies have shown that several drug residues are found in aquatic environments.

Among recent advances based on pharmaceutical effluent treatment techniques, photochemistry is presently solving the problems of pollution of aquatic environments.

In the photo-degradation processes of drugs, the semiconductor, zinc oxide (ZnO) is the most photoactive support in many photocatalytic reactions.

The objective of this study is to investigate the use of an active photo-material ZnO in the presence of a polychromatic light source in order to remove an anti-inflammatory drug diclofenac in a double-tube reactor.

The results obtained show that the photo degradation by poly chromatic light gives satisfactory results, in particular the reduction in the chemical oxygen demand of the drug under study.

***Keywords:** drug, environments, photo degradation, poly chromatic light, active photo material.*

P124: ESTABLISHMENT OF THE REFERENCE LEVEL OF RADIOACTIVITY AROUND NUCLEAR INSTALLATIONS

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Abstract

The main objective of this work is to characterize the different compartments of the environment, by considering air, soil and fresh water samples, in order to establish a reference level of natural and artificial radioactivity. Thus, soil samples were collected from different undisturbed areas in Nuclear Research Center of Draria (CRND). Samples were collected, conditioned and analyzed by direct counting by gamma spectrometry in the Environmental Laboratory of Nuclear Research Center of Algiers (CRNA). The results clearly show the presence of a normal rate of natural radionuclide in soil samples. As for artificial radioactivity, it is represented by trace amounts of ^{137}Cs in the soil, resulting likely from the nuclear weapons tests or nuclear accidents, such as Tchernobyl.

***Keywords:** Radioactivity, ^{137}Cs, Air, Soil, water, gamma spectrometry.*

P125: DETERMINATION OF THE CONCENTRATION OF HEAVY METALS IN INDOOR AIR BY ED-XRF TECHNIQUE

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Abstract

Indoor pollution is a form of pollution affecting closed residential environments such as workplaces or homes. This kind of phenomenon generates numerous sources of pollutants whose toxicity is not to be proved and which contribute to forming an environment dangerous for humans in the long term. This pollution is endogenous or exogenous. The purpose of this work is to determine the concentration of heavy metal pollutants in air filters by the ED-XRF (Energy Dispersive-X-Ray Fluorescence) technique. Two types of low volume samplers (Gent sampler, PM2.5 and PM10) and another TSP were used to collect the suspended particles in the indoor air at the dental prosthesis preparation laboratory located in a University Hospital. The use of this technique has been decisive in that it allows us to detect the elements in the state of traces and its relative simplicity. The qualitative and quantitative analysis of air filters reveals the presence of harmful elements such as lead (Pb), iron (Fe), cobalt (Co)) with concentrations at different levels, some of which may exceed thresholds Standards.

Keywords: *ED-XRF, PM2.5, PM10, air quality, heavy metals.*

P126: SAFETY REQUIREMENTS IN THE MANAGEMENT OF NORM RESIDUES: PHOSPHOGYPSUM CASE

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Abstract

The term NORM stands for Naturally Occurring radioactive Material. It refers to materials found naturally in the environment (e.g. minerals) which contain naturally occurring radioactive isotopes (e.g. isotopes of Uranium, Thorium and their radioactive decay products such as Rn gas).

Certain industries manipulate significant quantities of NORM, which usually ends up in their waste streams which can be defined as NORM residues. A NORM residue is a material that remains from a process and comprises or is contaminated by naturally occurring radioactive material, it can be in solid or liquid form.Its management is important, as accumulating residues can have potential radiological impact on workers, members of the public, and the environment.

As a result, regulatory control of those radioactive residues is necessary. In this regard, the objective of the safety requirements is to protect people and the environment from harmful effects of ionizing radiation. One of the efficient solutions to minimize the environmental and public radiological impact of NORM residues suggested by The IAEA safety standards is its recycling, or its use in other applications rather than disposing of it as waste. There are many opportunities for recycling NORM residues back to the processes that generated them. Similarly, there are many opportunities for the safe use of NORM residues as by-products.

We will describe through this work the radiological impact of the production of Phosphogypsum on the health and the environment, the important role of safety requirements in the management of Phosphogypsum through the national and international safety standards. We will also comment on the compliance of the Morrocan safety measurements through the prescriptions of the 142-12 law related to nuclear and radiological safety and security with the IAEA safety standards in the management of NORM residues.

Keywords*: Naturally Occurring Radioactive Materials, NORM residues, Phosphogypsum*

P127: MEASURE OF NATURAL RADIOACTIVITY OF ENVIRONMENTAL SAMPLES BY USING A PORTABLE GEIGER MULLER COUNTER

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Abstract

Radioactivity is present in the all environment compartments (Air, Soils, waters and vegetations). The paper aim to determine a reference level of natural radioactivity presents in groundwater by using a portable Geiger Muller counter. The exposure to radioactive materials impact is defined by calculates the accumulated absorbed dose. We focus on the determination of the global radioactivity in water samples. Eight 8 samples of groundwater has been collected. Water samples were acidified and evaporated with hotplate at a constant temperature (60 °) until obtaining a small volume (1 liter). Conditioned samples were measured with a Portable Geiger Muller counter (for 10 h).The calculated radioactivity was vary from 0,17 Bq/l to 0,19 Bq/l and the equivalent dose was vary from 20 µS/year to 29 µS/year. These results indicate that's groundwater samples have a low radioactivity and are safe for human consumption.

P128: INTERNAL AND EXTERNAL QUALITY CONTROL PROCEDURES APPLIED FOR NEUTRON ACTIVATION ANALYSIS LABORATORY USING ES-SALAM RESEARCH REACTOR

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Abstract

The need for demonstrating the analytical quality of the method becomes more and more important. For that, the concept of QC/QA, internal and external validation is considered as an advanced stage in the life cycle of an analytical method. In this study, about ten (10) SRM and RM of NIST, IAEA and WEPAL have been analyzed to evaluate the performance of the neutron activation analysis laboratory using different matrix such as plant and sediment. Three statistical parameters Z-score, U-score and the relative bias were evaluated used in this study.

For the external quality control our participation in inter-comparison programs is an important process to enhance the accuracy and precision of the analytical techniques used in the laboratories. At Es-Salam Research Reactor, our laboratory uses two functional analytical techniques such as INAA and k-INAA in the research projects and for the completion of the service works. Recently, our laboratory has participated in several inter-comparison tests organized by IAEA to assess the analytical performance of 32 laboratories from 31 member states in conjunction with WEPAL, the Wageningen Evaluating Programs for Analytical Laboratories. The Proficiency Testing tests related to the determination of major, minor and trace elements in materials of the International Soil and Plant Analytical Exchange (Wepal codes ISE, IPE), were held during 2011 -2015. All results were evaluated and reported in this paper.

P129: GAMMA RAY SPECTROMETRY: SELF-ABSORPTION CORRECTION FOR CYLINDRICAL GEOMETRY USING AN EMPIRICAL METHOD

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Abstract

In radioactivity measurements at laboratories, gamma ray spectrometryis the method of choice, as most radionuclides are gamma emittersand it is applied to a large number of samples, in different geometries (eg: Marinelli, cylindrical). Ideally, calibration of each measurement geometry is performed by using a variety of calibration sources to establish the specific detection efficiency curve for each measured sample (eg: soil, sediment, grass, water, foodstuffs….). However, just few sources for efficiency calibration are available, the efficiency curve should be determined by specific methods.

Keywords:*Gamma Rays spectrometry, Environmental radioactivity measurements, Self-absorption correction, Transmission measurements, Cylindrical geometry*

P130: HYDROGELS SYNTHESIS OF POLY (N-VINYLPYRROLIDONE) BY IRRADIATION AND ITS CHARACTERIZATION.

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Abstract

A hydrogel is a three-dimensional network formed by hydrophilic polymers in which

a big quantity of water is present. The main characteristic of this material is its capacity to be inflated in the presence of water without dissolving.

Hydrogels find their applications in diverse fields such as agriculture, cosmetic, and depollution. In the medical domain, they are used as materials for contact lenses, for healing of wounds as well as for repair and regeneration of a lot of tissues and organs.

Our work constitutes a contribution to the development and the design of a bandage of a hydrogel based on the poly (vinylpyrrolidone) to the improved properties. The latter are intended to relieve burns and also to act like effective barrier against the germs and the foreign particles.

Hydrogels of homopolymers: poly (vinylpyrrolidone) (PVP) at different fractions of polymer were synthesized in aqueous solution by gamma 60 Co γ-ray irradiations at various radiation doses, then were characterized.

The study of the swelling behavior of these hydrogels was conducted in a neutral medium (distilled water) and at room temperature. The values of the equilibrium degree of swelling (EDS) or (Qe) showed that with increasing the irradiation dose, the PVP hydrogels become less absorbent. In addition (Qe) values vary in not monotonous way with increasing on the polymer fraction.

Thermogravimetric analysis (TGA) showed that our hydrogels are thermally stable up to a temperature of 250°C.

Keywords: *hydrogel, poly(vinylpyrrolidone), burns, gamma ray, irradiations.*

P131: COMPARATIVE ANALYSIS OF POTTERY BY X-RAY FLUORESCENCE IN ALGERIA

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Abstract

The applications of analytical techniques are used in various socio-economic sectors (industry, medicine, geosciences, environment, cultural heritage, etc.). In the frame work of multi-elemental analysis, we useda photon beam for simultaneous determination of all the elements present in the sample by X-ray fluorescence (XRF). In this technique, the characteristic spectral line radiation emitted by the analyte is measured to determine the element concentration.

The calculations are based on the "fundamental parameters" approach in XRF, using the X-ray properties of the elements.

In the field of archeology, this technique is very useful. Being non-destructive, it offers the ability to quickly analyze a large number of samples, and helps to solve difficult analytical problems where chemical methods prove limited. The analysis allows differentiating and characterizing materials to know the technique of manufacturing, to establish classification of collections and to find the sources from excavations of objects discovered and to use them as reference materials.

In this work we have determined the composition of two potteries found in the romans ruins of Tipaza and Tamentefoust near Algiers which show similarity, in particular for Si, Al, S, Ca and Fe.

P132: MÖSSBAUER SPECTROSCOPIC STUDY OF IRON PHOSPHATE GLASS FOR RADIOACTIVE WASTE STORAGE

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Abstract

Detailed characterization was carried out on an iron phosphate glass waste form containing 20 wt.% of Ce-rich complex nuclear waste mixture. The Fe^{3+}/Fe ratio of this waste loaded iron phosphate glass was investigated using Mössbauer spectroscopy, which reveals the presence of iron cations in two different oxidation states (Fe^{2+}& Fe^{3+}) and all Fe^{2+} occupied the octahedral coordination state, while some Fe^{3+} occupied the tetrahedral coordination state and the rest occupied the octahedral coordination state. With the addition of Fe_2O_3 to the glass, the P−O−P bonds are replaced by P−O−Fe^{2+} and/or P−O−Fe^{3+} bonds, which are more chemically durable. The measured properties of the waste loaded glass comply with the characteristics of both pure iron phosphate glass and literature.

P133: ASSESSEMENT OF RADIOACTIVITY LEVELS IN SOME BUILDING MATERIALS USED IN ALGERIA

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Abstract

Ionizing radiations emitted by natural and artificial radio nuclides have always existed in building materials which directly affect human beings,and can contribute in accumulated dose in long term. The objective of this work is an investigation ofthe levels of natural and artificial radioactivity associated radiation hazard in some Algerian building materials.

A total of nine samples (cement, clinker, ceramic, brick and gypsum) were collected from factories and construction sites situated in the East and Center of Algeria. The preparation of soil samples required drying, crushing and sieving for fine diameter particles.The sample analysis was undertaken by gamma spectrometry,using

a high resolution HPGesemi-conductor detector with (1.8 keVfor 60Co 1332.5 keV line).The spectra wereanalyzed using the Genie 2000 software dedicated to the processing of gamma spectra.

A combination of an experimental approach and Monte Carlo simulationby using MCNP5 has been used for detector calibration to determine reactivity concentrations of 226Ra, 232Th, 137Cs

P134: DEGRADATION BY GAMMA RADIATION OF FENITROTHION PRESENT IN SEWER WATER

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Abstract

The present study is focused on the use of gamma radiation to reduce organic compounds in wastewater, first on a synthetic aqueous solution of fenitrothion, which is an organophosphorus pesticide, then on a real sample of wastewater.

On the synthetic solution, the study was conducted with a concentration of 150ppm of fenitrothion submitted to gamma rays of ^{60}Co to absorbed doses varying from 15 to 50kGy. The results showed that on the one hand, the pesticide concentration decreased with dose increasing and, on the other hand, irradiation acidifies the pH of solution, which passed from 5.17 to 3.21 at 50kGy.

The HPLC analysis has shown that 90 % of the fenitrothion contained in the solution was degraded at the dose of 50kGy.Some by-products formed during irradiation were identified.The study on wastewater was conducted on real samples collected from a purification plant influent that receives industrial and domestic wastewater. Samples were irradiated in 2 -12 kGy dose range. The results showed the decrease of the pH of the influent sample with the increase of the absorbed dose. The chemical oxygen demand(COD) of irradiated and non-irradiated samples wasdetermined. The results showed that gamma radiation at the dose of 12kGy reduced by 46%the COD of the influent. The degradation study was followed by HPLC and GC-MS and the results reveal the presence of trace of fenitrothion in the influent control sample,this trace disappeared in the sample irradiated at 2kGy.

P135: RAMAN DEPTH PROFILING SPECTROSCOPY OF A-AL_2O_3SINGLE CRYSTAL SEQUENTIALLY IRRADIATEDWITH REACTOR NEUTRONS AND 90 MEV XE IONS

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Abstract

A rigorous material testing program is essential for the development of the nuclear fusion world program. In particular, it is very important to know the generation of the displacement damage in materials, because the irradiation intensity expected in fusion conditions is such that the performance of materials. To study the damage produced by neutrons and swift ion in materials of interest for fusion. and for that we have use Al2O3 for test materials.

Radiation damage induced in Al2O3 single crystal irradiated by reactor neutrons and 90 MeV Xe ions were investigated by Raman Depth profiling spectroscopy techniques. The irradiation to the fast neutrons was performed at NUR research reactor, Algiers at about 40° C and with different fluences in the range from 1016 to 1019 n/cm2. The irradiations with 90 MeV Xe ions were performed at room temperature at GANIL, Caen, France using the IRRSUD beamline in the range from 1012 to 1014 Xe/cm2. The study presented in this communication is focused on the effect of the defect generated by reactor neutron irradiation followed by swift heavy ion in Al2O3 single crystal. The comparison of the data obtained after irradiation are observed and discussed.

Keywords: *fast neutrons; irradiations; nuclear materials; Raman; phonon; defects; Amorphization; Al2O3.*

P136: AN EASY TRUE-COINCIDENCE CORRECTION FACTORS DETERMINATION FOR BULKY SAMPLE IN CLOSE GEOMETRY MEASUREMENT TO THE N-TYPE HPGE DETECTOR

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Abstract

An easy semi-experimental method is developed for use in quantitative gamma-spectrometry analysis procedures, to estimate the γ-γ true-coincidence correction factor (kTCS) in extreme measurement conditions; for bulky sample, involving nuclide with very complicate decay schema (125Eu nuclide), counted in close geometry to the N-type HPGe detector. The proposed method provides an advantageous alternative to analytical methods that needs the determination of the total efficiency by means of analytical preparation of a set of expensive mono-energetic sources, or by using Monte-Carlo calculations which is limited by the exact knowledge of the germanium detector's geometry; its active volume, dead layer thickness, and shifting in detector cryostat. The method presented in this paper combines experimental measurements and Monte Carlo calculations, where the MC calculations depends only of detailed composition and geometrical dimensions of the voluminous source. The validity of using this method was successfully demonstrated by comparing the predicted (kTCS) values with those one obtained with two distinct methods that are; GammaVision software, and the MCNPX calculation of the optimized model of the N-type HPGe detector.

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