[02/09/03 - Poster]

Study of neutron-DNA interaction at the BNCT Research facility at IPEN.

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Our group at the Laboratorio do Acelerador Linear (IFUSP- USP) is currently developing several studies related to the interaction of different kinds of radiation with DNA. Initially, our plan is to study the interactions proton-DNA, gamma-DNA and neutron-DNA. In this work we describe the most important features of the neutron-DNA study, which we plan to perform by selecting termic, epitermic and fast neutrons. To improve the information about radiation-DNA interaction is important in order to achieve more secure and efficient cancer treatments by using radiation therapy. Nowadays, one important technique is the boron neutrons capture therapy, where neutrons are used to initiate a nuclear reaction at the tumor site. The effects of the neutrons on the health tissue, however, must be better understood. The study of neutron-DNA interaction, in this scenario, is of great importance. The research facility for Boron Neutron Capture Therapy (BNCT) in the IEA-R1 Reactor of the IPEN-CNEN/SP will be used for studying the neutron-induced DNA damage. At present, we are evaluating the characteristics of the neutron flux at the biological sample, and we are caring out simulations of the experimental procedure through Monte Carlos N- particle transport code system version 4C (MCNP-4C) to find the experimental conditions necesary to minimize such contamination, and also investigate possible experiments to verify the effects of those gamma's on the DNA molecule. The first step is the selection of filters and moderator configurations, which will allow us to irradiate the DNA sample with thermic, epithermic and fast neutrons. We present the results of our simulations, and describe the experimental setup show the best sets of materials necessary to obtain neutron spectra for different neutrons energies.

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Development and testing of a Radon chamber for plastic detectors calibration

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A calibration system for radon and radon progeny concentration in the air was developed in Laboratório de Dosimetria (IFUSP). The aim is to make possible the assessment of the exposure of general public to these contaminants in the atmosphere of dwellings and workplaces. A radon chamber was mounted in order to provide the controlled irradiation of plastic detectors (LR115 and CR39 solid state nuclear track detectors). The factors affecting the calibration process for radon monitors or sources, such as a good sealing, low ventilation conditions, radon and radon progeny homogeneity or radon progeny plate-out were taken into account in the chamber design. The chamber has a cylindrical form with stainless steal walls and with approximately 0.8 m^3 of internal volume to avoid the influence of the plate-out effect in the homogeneity of radon progeny in the center of the chamber. A small glass port of 15x15 cm^2 in the upper part of the chamber avoids critical losses of radon gas when monitors are placed inside or withdrawn from the chamber. A dry Ra-226 source (Model 2000A - Pylon Electronics) with an activity of 96.6 (3.9) kBq and a controlled aperture gives rise to a production of 12.6 Bq/min of Rn-222. Arrangements of opening and closing procedures of the radium source permit a variety of radon gas concentrations in the internal volume. The verification of radon and radon progeny homogeneity, gas leakage, gas activity calibration and absence of ventilation inside the chamber were evaluated giving good results.

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High Dose Dosimetry on Radiation Processing at ^{60}Co gamma field

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The processes induced by ionizing radiation, such as food preservation and disinfestation, sterilization of health care products, tissues sterilization for surgical implants, gems inducing color, polymers modification, and others, at ^{60}Co gamma ray irradiation facilities of the Center of Radiation Technology (CTR) at Institute for Energetic and Nuclear Research (IPEN), generate products and services for customers of the industry, agriculture, medicine, radiobiology and environmental.

In radiation processing, the essencial quantity is *Radiation Absorved Dose*, therefore, a well characterized reliable dosimetry system that is traceable to recognized national and international dosimetry standards is the key element of such activities. The dosimetry procedures for radiation processing in our Laboratory of High Dose Dosimetry are carried out in agreement with the ASTM (American Society Testing and Materials) standard guides and practices. To check on the enteire dose measurement system, i.e., dosimeters, measurement equipment, procedures for the use of the system, data transfer procedure and to establish a reliable dosimetry system we have participated of the intercomparisons of gamma dose measures among International Dose Assurance Service (IDAS) offered by the IAEA (International Agency Energy Atomic).

This work shows the results of several materials used to measure the dose absorved and the dose distribution, and to control the routine radiation process. Fricke solution as reference standard dosimetry system, Alanina

(IDAS-IAEA) as transfer standard dosimetry system and Radiochromic Films as routine dosimetry system are the dosimetry systems for quality control of irradiation processes for Gammacell and Panoramic Irradiators of the CTR. The response of routine dosimeters are often influenced by changing dose rates, irradiation temperature, post irradiation and also environmental conditions. Studies and evaluations of these parameters were carried out so that the radiation absorved dose by products may be precisely and accuratelly measured.

[02/09/03 - Poster]

Deviations between measured and S-matrix theory predictions of coherent differential scattering cross sections of 59.54 keV photons incident on silver.

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The investigation of the interaction of gamma and X-rays with matter is important in basic and applied sciences. The absorption and scattering of photons is present in, for example, non-destructive testing of materials, diagnostic and therapeutic radiology, computerized tomography.
Besides their importance in applied science, measurements of coherent scattering of photons by bound electrons, known as Rayleigh scattering, are the most important test for calculated scattering amplitudes. In the low energy range, near absorption edges, an accurate knowledge of the elastic cross-section is particularly important.
Imaging techniques, using gamma or X-rays, are based on differences in the attenuation of photons that traverse different regions of the object (or of the patient, if dealing with medical images). In that case, scattered radiation is undesirable (but cannot be avoided) because it degrades the image, by reducing its contrast. A better knowledge of these scatering processes may thus lead to technical improvements as well as to more refined theoretical descriptions.
We have measured the coherent (or Rayleigh) differential scattering cross sections of 59.54 keV photons of a ^{241}Am source incident on solid Cu, Ag, Cd, Pt, and Pb targets
Our results were compared with predictions made by usual form factor theories and also with an improved second order S- matrix pertubation theory, which yielded the best agreement with our data. However, for silver, conspicuous deviations persist.
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Collisional electron detachment of atomic anions by noble gases: an universal behavior at intermediate velocities

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Negative ions are relevant for a wide range of areas in natural sciences and technology. One important application in NUCLEAR PHYSICS is in the diagnosis and heating of FUSION PLASMAS as they are easily neutralized by the detachment of one electron. Another application in NUCLEAR PHYSICS is in the technology of ion sources for tandem accelerators, where they are usually produced by sputtering.
We have measured the total electron detachment cross sections of anions of the second and third periods of the Table of Elements in the 0.1-1.6 a.u. velocity range colliding with helium, neon and argon.
The experimental study of intermediate-velocity anions colliding with atoms and molecules has been limited by the non existence of appropriate apparatuses. Single-ended accelerators with negative ion sources at negative high-voltage terminal (hundred kV or MV) are rare. Recently we developed a simple method to measure absolute cross sections for total electron detachment or for destruction of fast negative atomic or molecular ions colliding with atoms and molecules at intermediate velocities. It supposes the existence of a negative ion source and a tandem accelerator. For example, in our laboratory negative ion beams were produced in a sputtering ion source and pre-accelerated to a kinetic energy E. After mass selection in a Wien filter, they acquire an additional energy e x V in the first stage of the tandem accelerator, where the potential V may be as high as 1.7 MV. The method uses the electron detachment process of the negative ions occurring at the stripper placed at the accelerator high-voltage terminal. The gas density is obtained from the measurement of the high-energy end pressure with a method we developed. In short, for each gas (He, Ne and Ar), published values of single electron loss cross sections of H^- are used to make a correspondence between the stripper gas pressure and the pressure at the grounded high energy end of the accelerator. The normalization of the incident beam is simplified due to the stability of the modern accelerators.
Universal trends were found: the cross sections show similar velocity dependence for any given target and their ratios, for the same column of the table, scale with the same target-independent factors. Explanations for these facts will be presented.
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