BỘ MÔN TIN VẬT LÝ –KHOA VẬT LÝ,
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Seminar

Date: Fri. Sep. 22th, 2017/ Time: 2:00 pm – 3:00 pm / Place: Room 408F, Building T1

334 Nguyễn Trãi, Thanh Xuân, Hà Nội

Kính mời thầy cô và các bạn quan tâm đến dự / Everyone is welcome !

Speaker: TRINH Ngoc Duy, PhD student in nuclear physics (*Grand Accélérateur National d'Ions Lourds (GANIL), Normandie Université, UNICAEN, France***)**

Title: Investigation of double differential neutron spectra induced by the interaction of heavy ions on thick target

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Abstract: New generation of accelerators (SPIRAL2, RIBF, FRIB…) is being constructed for both fundamental nuclear physics research and industrial applications such as radiotherapy and material irradiation. Along the increasing application of accelerators, the characterization of radiation hazards is necessary in order to maintain an adequate level of radiation protection, which is required by safety authorities. However, experimental secondary neutrons yields generated by the interaction of heavy ion beams are very rare. The lack of experimental data represents serious issues for the operation and the design of heavy ion accelerator facilities particularly concerning radiation dose optimization (the ALARA principle) and biological shielding calculation. Furthermore, investigation and modeling of heavy ion reactions mechanisms require also a well-established library of secondary neutron experimental data.

A Thick Target Neutron Yields (TTNY) experimental campaign is thus being carried out at GANIL, with the aim to measure double differential neutron spectra (energy, angle) generated by interactions of heavy ion beams of incident energies from 4 MeV/nucleon to 95 MeV/nucleon and of projectile masses from 24 to 208 on thick target. Two techniques of neutron measurement are simultaneously performed to determined neutron yields: the activation method and the Time of Flight method, which allows having a redundancy and deepness of experimental results.

Analysis of experimental data shows an agreement of neutron spectra measured by the two measurement techniques. However, a significant disagreement between experimental results and the calculation from general purpose Monte-Carlo nuclear simulation codes (FLUKA, PHITS) have been observed. Simulation codes overestimate systematically neutron yields. This disagreement may come from the bad modeling of heavy ion reactions at experimental conditions: low beam energy and high mass of incident ion and target nucleus.

This overestimation could have several consequences on the dimensioning of accelerator facilities or for their exploitation such as an overestimation of radiation shielding thicknesses. Differences between the calculations and the experiments also indicate a need for theoretical study for the improvement of heavy ion reaction modeling at this energy scale.

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Keywords: Thick Target Neutron Yield, Activation, Time of Flight, Heavy ion reaction, Monte-Carlo simulation, FLUKA, PHITS