Consortium for Verification Technology and the Institute of Nuclear Materials Management at U-M Present

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"Detailed Modeling of Fission"

Oct. 29, 2014, 11:30 AM in the Baer Room, Cooley

Food will be provided!

More than 75 years after the discovery of fission, much remains to be understood on more than a qualitative level. While there have been intense recent efforts to improve upon fission theory, this talk focuses on achieving the best possible phenomenological understanding of fission. For better or worse, phenomenology depends on available data, both as input for the models and, as output, as a measure of comparison. The first part of the talk reviews some of the available input and output data. We then turn to models of fission, from the Los Alamos model to more recent efforts. For many years, the state of the art for modeling fission in transport codes has involved sampling from average distributions such as those produced by the Los Alamos model. These ``average" fission models have limited capabilities. Energy is not explicitly conserved and no correlations are available because all particles are emitted isotropically and independently.

However, the energies, momenta and multiplicities of particles emitted during fission are correlated. Correlations are only calculable in models that produce complete fission events. Recently, several Monte Carlo codes have become available that employ event-by-event techniques. These methods are particularly useful because all event information is kept, making it possible to extract any desired correlation observables. Such codes, when included in broader Monte Carlo transport codes can be made broadly available to the community. Our fast event-by-event fission code FREYA (Fission Reaction Event Yield Algorithm), one such code, generates large samples of complete fission events. We go step by step through the physics in FREYA, describing the inputs and methodology. We also describe some of the other available models and compare our FREYA calculations with results from other models. Finally, we present some new results on neutron-neutron correlations.