A Proposal for New Treatment of Radiation Behavior with Combination of Nuclear Data and Reaction Model.

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The nuclear data are extensively used in the Monte Carlo transport calculations to analyze the radiation behavior in various fields such as accelerator facilities, spacecrafts, and radiotherapy. Most of the Monte Carlo transport calculations are based on Boltzmann equation for one-body phase space distribution of the transport particles. By such transport calculations, particularly with the nuclear data, one could obtain only the mean value of the one-body observables in the phase space, e.g. heat, flux, and so on. We cannot calculate the fluctuations around the mean value, since the Boltzmann equation has no information for the two-body and higher order correlations which determine the fluctuation around the mean value.

Recently, however, the higher order quantities, i.e. the fluctuations around the mean values of the one-body observables are often required in a certain field. A typical example for such a correlated quantity is the deposit energy distribution in a cell, which is necessary for the estimation of the response function of the detector or a single event upset probability of a semiconductor memory cell. The solution of the Boltzmann equation cannot describe the distribution but only the mean value. Furthermore, Monte Carlo calculations by using the nuclear data cannot deal with these quantities, since the nuclear data includes only the inclusive one-body cross sections but no information of the correlations.

We have therefore developed a new treatment of radiation behavior in the transport calculations by combining the nuclear data with the reaction models so as to trace all higher correlations. We would like to discuss a possibility of this new treatment in the nuclear data field.