Contribution ID: **36** Type: **Oral**

Neutron and Gamma Nuclear Reaction Data Calculations in CENDL

Friday 12 July 2024 11:35 (15 minutes)

Neutron and gamma induced reaction data are the important elements in diversified nuclear applications. The complete nuclear reaction information includes the nuclear reaction cross sections, angular distributions, energy spectrum et al. The study of nuclear reaction data and the relevant covariance in China have been carried out for decades under the joint collaboration of China Nuclear Data Center (CNDC) and the Chinese Nuclear Data Cooperation Network (CNDCN).

Restricted by experimental measurement conditions, theoretical model calculations are the unique way to provide complete and consistent nuclear reaction data. The optical models, the equilibrium and pre-equilibrium models for the compound nuclei, principle of detailed balance and so on jointly built a nuclear reaction platform to produce the nuclear data. Some representative theoretical methods and methodologies are studied in Chinese theoretical calculations for neutron and gamma data, which will be introduced in this work.

As for the neutron induced data, the hybrid approach with the R matrix and the statistics models are built for light nuclei on the 1s and 1p shells; the unified Hauser-Feshbach model and exciton models are developed and adopted in the middle-heavy mass region, and these models are recently being developed at the neutron incident energy from 20 to 30MeV; moreover, the program MINUIT et al. is added in the system to accelerate the optimization process. The large-scale calculations are feasible for the next sub-library of nuclear reaction data, and more than 400 nuclei will be released in the next CENDL. In addition, the more fundamental theories from the Classical Density Functional Theory (CDFT) and the calculation based on the ab initio theory are also applied in the nuclear structures, the multi-fission chambers and optical models et al. to improve the calculation environment of nuclear reactions. Besides, the methodologies of covariance are built for the cross sections based on the deterministic and random approaches.

As for the gamma induced data, the nuclear reaction models with multi-particle emission below 200 MeV are built in CNDC both for light nuclei and heavier. The photon absorption in the giant dipole resonance region is considered both with the various empirical Lorentz functions and the quasiparticle random-phase approximation for the spherical nucleus and deformed nuclei. Also, the optimized method is compiled with the main nuclear reaction codes, which help us to generate more data in the scheme. We also systematically investigate the measured photon nuclear data in Table and add machine learning method to analyze the data. More than 200 nuclei have been achieved using this scheme.

Primary author: XU, Ruirui (China Institute of Atomic Energy)

Presenter: XU, Ruirui (China Institute of Atomic Energy)

Session Classification: Nuclear Data II

Track Classification: Nuclear data evaluation