5 - 26 Measurement of Leakage Neutron Spectra from ^{238}U Slabs with D–T Neutrons and Validation of Nuclear Evaluation Data Libraries

Sun Qi, Chen Zhiqiang and Han Rui

The accurate nuclear data for ^{238}U are of great importance in the design of the Accelerator-Driven Sub-critical Systems (ADS). An integral experiment was carried out at China Institute of Atomic Energy (CIAE) to measure the neutron spectra from pure Uranium-238 slabs with 14.8 MeV D-T neutrons using Time-of-Flight (TOF) Method. The leakage neutron spectra at 60° and 120° have been measured for different sizes of the slabs (10 cm×10 cm×2 cm, 10 cm×10 cm×5 cm, and 10 cm×10 cm×11 cm). The simulations with MCNP-4C code coupled with different nuclear evaluation data libraries (ENDF/B-VII.1, JENDL-4.0, CENDL-3.1, JEFF-3.2 and TENDL-2015) have been performed. Fig. 1 shows the comparison of measured and calculated leakage neutron energy spectra for 14.8 MeV neutron on the Uranium-238 sample in size of 10 cm×10 cm×2 cm. It is found that JENDL-4.0 fitted the experimental data best.

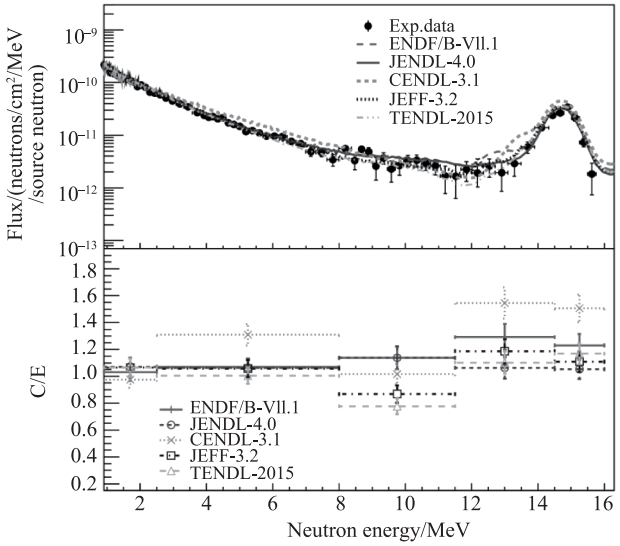

Fig. 1 Comparison of measured and calculated leakage neutron energy spectra for 14.8 MeV neutron on a ^{238}U sample (10 cm×10 cm×2 cm).

5 - 27 Study of Energy Spectra of Light Charged Particles from ^{12}C + ^{12}C at 95 AMeV with Moving Source Model

Tian Guoyu, Chen Zhiqiang, Han Rui and Roy Wada

The ^{12}C + ^{12}C reaction at 95 MeV/u was performed at GANIL [1], motivated by the hadron beam therapy with carbon ions to treat cancerous tumors. In Ref. [2] the angular distributions and energy spectra of the outgoing particles were compared with the reaction models embedded in the GEANT4 and none of the toolkits provide good enough reproductions of the experimental data. In order to reproduce the energy spectra and elucidate the production mechanism of LCPs, the moving source model was applied to analyze the energy spectra of light charged particles.

In the moving source model, three sources, projectile-like fragment (PLF), intermediate velocity (IV), and target-like fragment (TLF) sources[3] are used to describe the energy spectra of LCPs particles. The IV source has a source velocity of about a half-projectile velocity and a harder slope, comparing to those of PLF and TLF. Each source has four parameters, multiplicity, energy slope (or temperature), Coulomb barrier, and source velocity. Typical results after optimizing these parameters for protons and ^{4}He particles at selected angles are shown in Fig. 1.

For ^{4}He particles on the right column, each source dominates at specific angle(s), *i.e.*, PLF dominates at 11°, the IV source at 19° and TLF at 41°. For protons on the left, the dominance of each source at a given angle becomes

less distinct. The TLF source represents only the low energy part of the spectra at all angles measured. At 11° and 19° PLF and IV sources dominate the major part of the spectra more or less equally. At 41° the spectrum is dominated by the IV source.

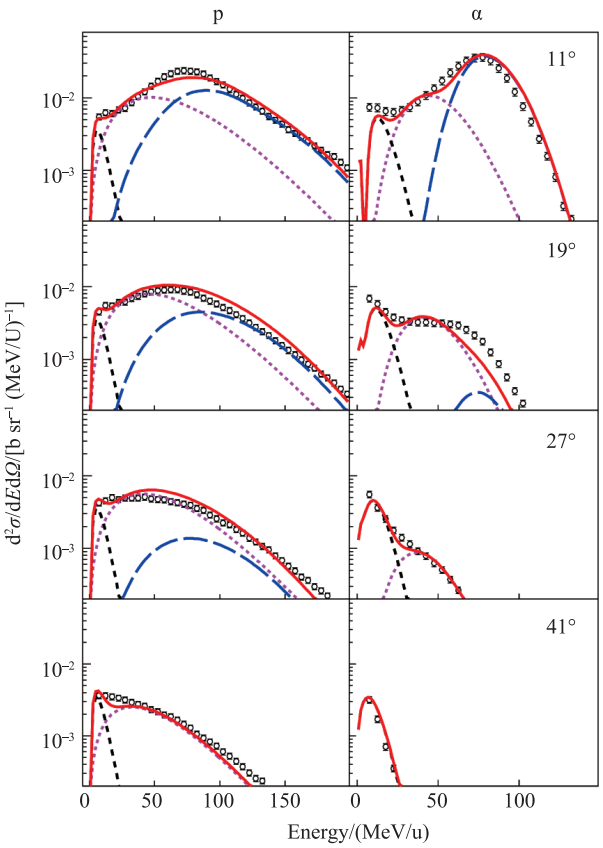

Fig. 1 (color online) Moving source fit results for protons on the left column and ^{4}He particles on the right. The experimental data from Ref. [1] are shown by open circles. PLF, IV, and TLF components are shown by long-dashed, dotted, and dashed lines, respectively. The total sum of the calculated spectra is shown by solid lines. Theta Laboratory angles are shown in each figure.

References

[1] J. Dudouet, D. Juliani, M. Labalme, et al., Phys. Rev. C, 88(2013)024606.

[2] J. Dudouet, D. Cussol, D. Durand, et al., Phys. Rev. C, 89(2014)054616.

[3] R. Wada, D. Fabris, K. Hagel, et al., Phys. Rev. C, 39(1989)497.