KAERI Photonuclear Data Library

Young-Ouk Lee, Yinlu Han[1], and Jonghwa Chang
Korea Atomic Energy Research Institute
P.O. Box 105 Yusong, Taejon 305-600, Korea

Status of the Library

KAERI is building a photonuclear data library in response to nuclear data needs from various R&Ds and applications. Currently, total 143 isotopes of 38 elements are included in the evaluated photonuclear data library as follows:

- Structural, Shielding and Bremsstrahlung Target Materials
  ^{24,25,26}Mg, ^{27}Al, ^{50,52,53,54}Cr, ^{55}Mn, ^{54,56,57,58}Fe, ^{59}Co, ^{58,60,61,62,64}Ni, ^{63,65}Cu, ^{64,66,67,68,70}Zn, ^{90,91,92,94,96}Zr, ^{92,94,95,96,97,98,100}Mo, ^{112,114,115,116,117,118,119,120,122,124}Sn, ^{120,122,123,124,125,126,128,130}Te, ^{141}Pr, ^{165}Ho, ^{197}Au, ^{209}Bi.

- Biological Materials
  ^{12,13}C, ^{14,15}N, ^{16,17,18}O, ^{23}Na, ^{32,33,34,36}S, ^{35,37}Cl, ^{40,42,43,44,46,48}Ca.

- Nuclear Waster Transmutation
  ^{84,86,87,88,90}Sr, ^{93}Zr, ^{93,94}Nb, ^{102,104,105,106,107,108}Pd, ^{107,108,109}Ag, ^{127,129}I, ^{133,135,137}Cs, ^{144,147,148,149,150,151,152,154}Sm, ^{158,159}Tb.

- Actvation Analysis
  ^{28,29,30}Si, ^{36,38,40}Ar, ^{39,40,41}K, ^{46,47,48,49,50}Ti, ^{70,72,73,74,76}Ge, ^{110}Pd, ^{106,108,110,111,112,113,114,116}Cd, ^{121,123}Sb.

- Astrophysics

  Nuclei such as ^{27}Si, for use as a cosmological chronometer.

Theoretical Models and Evaluation Techniques

The Giant-Dipole Resonance (GDR) and the Quasi-Deuteron Model (QDM) are used to calculate the photoabsorption cross sections. The GDR parameters are adjusted by fitting the experimental data of photoabsorption cross sections or photoneutron cross sections. If experimental data exist for total photoabsorption cross section, it can be used to adjust the GDR parameters. For heavy nuclei, the total photoneutron cross section can be used to approximate the photoabsorption cross sections, since contributions from charged particle emissions are small. However, in light nuclei where the photoproton cross section is no longer small, the resonance parameters are adjusted in such a way that the decaying model calculation with the initial nuclear excitation reproduces available photonuclear reaction measurements. When the photoabsorption cross sections are established, the decay processes including neutron, proton, deuteron, triton and alpha particle emissions are calculated up to 140 MeV using GNASH code. Figure 1 shows some of our evaluation results of the photonuclear reaction for Mo, Zn, S and Cl isotopes, compared with available experimental data.

Acknowledgements

This work was performed under the auspices of Korea Ministry of Science and Technology as one of the long-term nuclear R&D programs.

[1]Permanent Address: China Institute of Atomic Energy

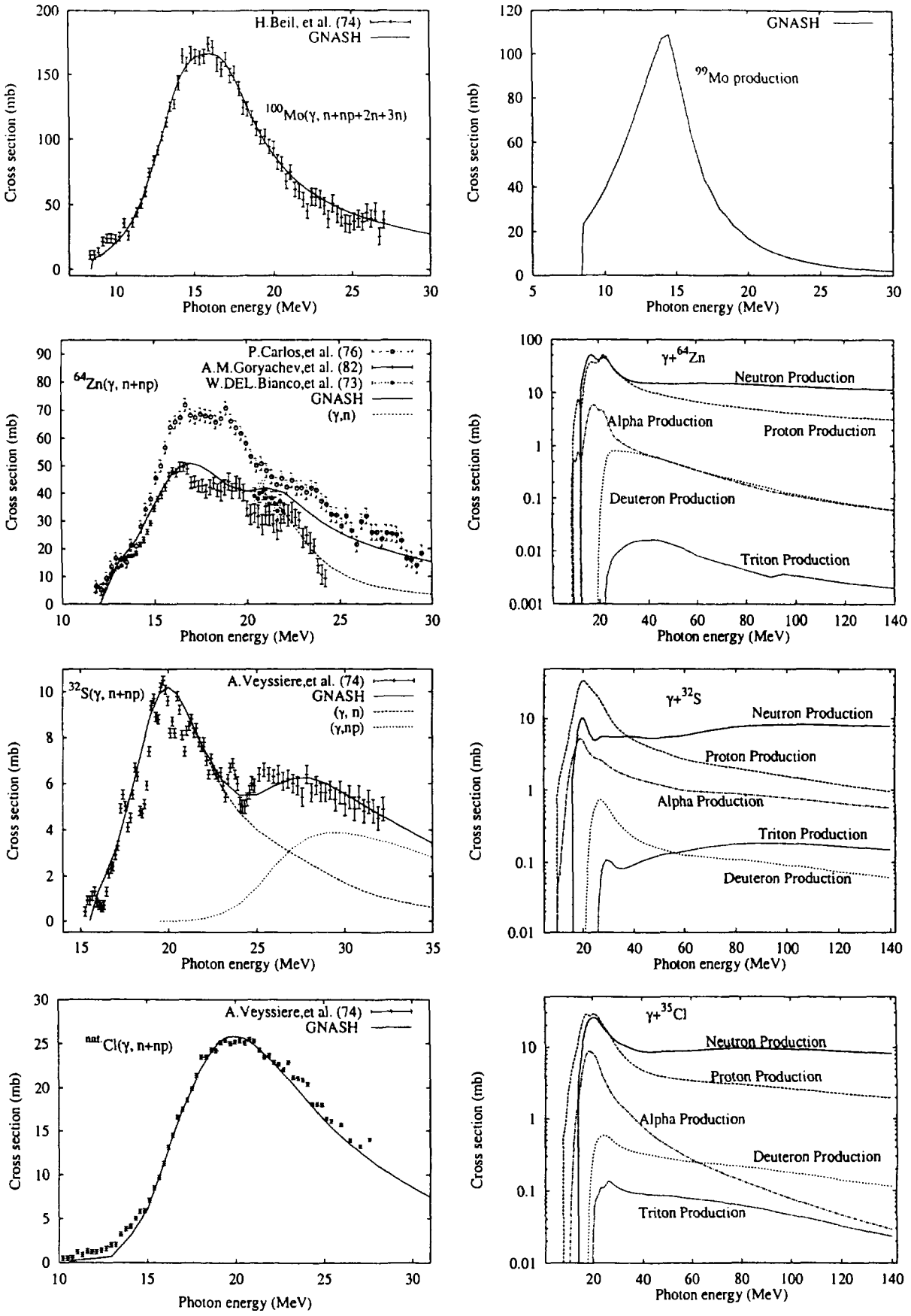

Figure 1: Comparison of calculated results with experimental data for Mo, Zn, S, and Cl photonuclear reaction cross sections