Experimental Activities in China

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The following nuclear data measurement laboratories are included in china Nuclear Data Network: China Institute of Atomic Energy(CIAE), Peking University, Lanzhou University，Sichuan University. The summarized activities are covered during recent years.

1. China Institute of Atomic Energy

The facilities were used for the nuclear data measurements and studies including the China's first experimental heavy water reactor, the HI-13 tandem accelerator, 600kV-Cockcroft-Walton accelerator and GTAF(Gamma Total Absorption Facility) detector in CIAE. The China experimental fast reactor and China advanced research reactor, which are under construction at CIAE, will be used for nuclear data related research in the next year.

Measurements of Neutron Emission Spectra of beryllium

The neutron emission double-differential cross sections of ^{9}Be were measured at incident neutron energies of 21.6 and 25.0 MeV. The experiment was performed with the Multi-detector Fast Neutron TOF Spectrometer at the HI-13 Tandem Accelerator at CIAE. Mono-energetic neutrons were produced by the T (d,n) ^{4}He reaction with a tritium gas target.

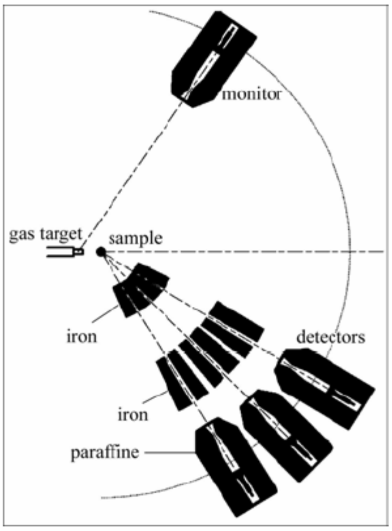


Fig. 1. Schematic view of the Multi-detector Fast Neutron TOF Spectrometer at CIAE.

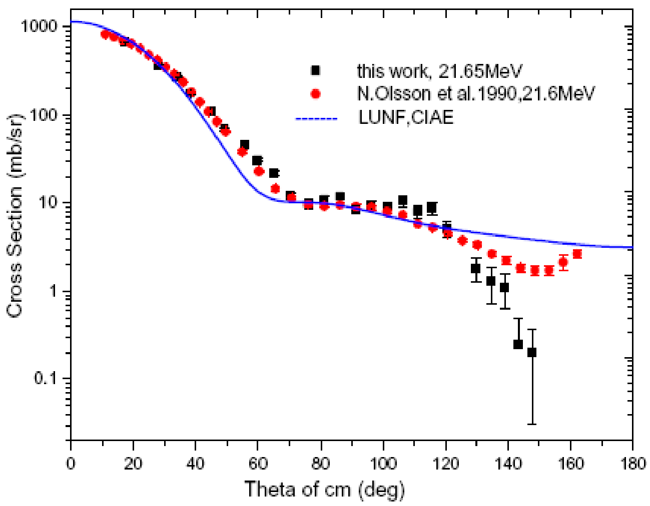


Fig 2. Elastic scattering differential cross sections of n+^{9}Be

- **Measurement of Half-Life**

Liquid samples of ^{93}Zr were isolated from high level liquid wastes by means of silica gel adsorption combined with tri-N-butyl-phosphate (TBP) extraction. Thereafter its radioactivity was determined by liquid scintillation counting (LSC) and its mass concentration by multi-collector inductively coupled plasma spectrometry. So a new value of ^{93}Zr half-life was found to be $1.13(6)\times10^{6}$ a.

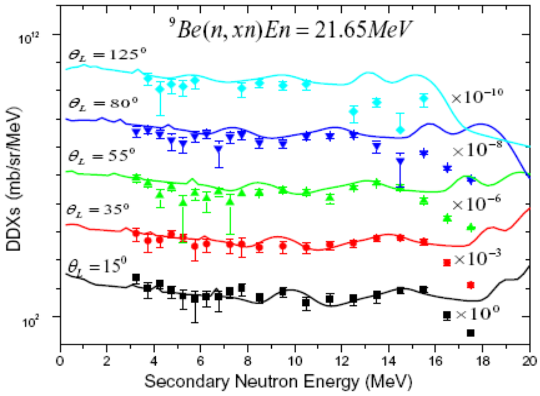


Fig 3. DDXs results (the elastic peak was excluded) comparing with theoretical calculations

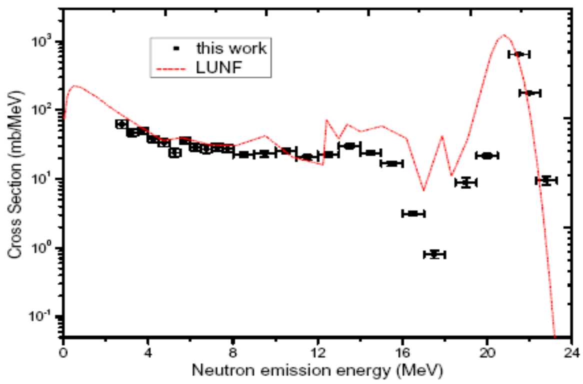


Fig 4. Angle integral cross sections of the secondary neutron emission spectra at 21.6MeV of n+^{9}Be

75mg $(NH_4)_6Mo_7O_{24}\cdot 4H_2O$ solution was irradiated for 20min in Miniature Neutron Source Reactor (MNSR) and cooled for 12min. In the conditions of 0.8mol/L HNO_3, phase ratio 1:1, the solution of ^{101}Tc sample was extracted twice and radiochemical purity ^{101}Tc product wad gained. The half-life of ^{101}Tc was accurately measured with a HPGe γ-detector following 306.8keV γ-ray about 150min, and processed the data by three methods, R-value method, iterative method and translation method. Measured 5 times and 14.02±0.01min was given for the half-life of ^{101}Tc and proved reliable.

Table 1 Comparison of ^{101}Tc Half-Life

Year	Author	$T_{1/2}$/min
1948	Perlman M L	14.5
1948	Mock D L	16.5±0.5
1954	Wiles D R	14.3±0.1
1957	O'Kelley G D	14.0±0.1
1960	Kumabe I	15±3
1990	Abzouzi A	14.224±0.008
2008	You Xinfeng	14.02±0.01

- **Study of collision between ions and atoms.**

The experiment was performed with the HI-13 tandem accelerator at the China Institute of Atomic Energy (CIAE). We tried to get the relations of scattering cross section energy, scattering cross section elements, inner shell ionization cross section energy, X-ray shift energy, and two-electron one-photon transition in inner shell etc. We measured C、Cu、F、O＋Au、Cu、Cd、Fe、Mo、Nb、Ni、Ta.

2. Peking University

- **Cross section measurements for the ^{143}Nd(n,α)^{140}Ce reaction**

Cross sections and forward/backward ratios for the ^{143}Nd(n,α)^{140}Ce reaction were measured at E_n =

4.0, 5.0 and 6.0 MeV using a twin-gridded ionization chamber and two large area back-to-back $^{143}Nd_2O_3$ samples. Experiments were performed at the 4.5 MV Van de Graaff of Peking University, China. Fast neutrons were produced through the $D(d,n)^3He$ reaction by using a deuterium gas target. A small ^{238}U fission chamber was employed for absolute neutron flux determination and a BF_3 long counter was as a neutron flux monitor. Present experimental data are compared with existing evaluations and measurements.

- **Cross section measurement for the ^{95}Mo(n, α)^{92}Zr reaction**

For the ^{95}Mo(n, α)^{92}Zr reaction cross section, there is only one experimental datum in the MeV neutron energy region with large uncertainty. As a result, very large deviations exist in different evaluated nuclear data libraries. The measurement of cross sections of the ^{95}Mo(n, α)^{92}Zr reaction at En = 4.0, 5.0 and 6.0 MeV. Experiments were performed at the 4.5 MV Van de Graaff of Peking University, China. A twin gridded ionization chamber was used as alpha particle detector and two large area ^{95}Mo samples placed back to back were adopted. Fast neutrons were produced through the D(d, n)^{3}He reaction by using a deuterium gas target. A small ^{238}U fission chamber was adopted for absolute neutron flux determination and a BF_3 long counter was used for neutron flux monitor. Present experimental data are compared with existing evaluations and measurement.

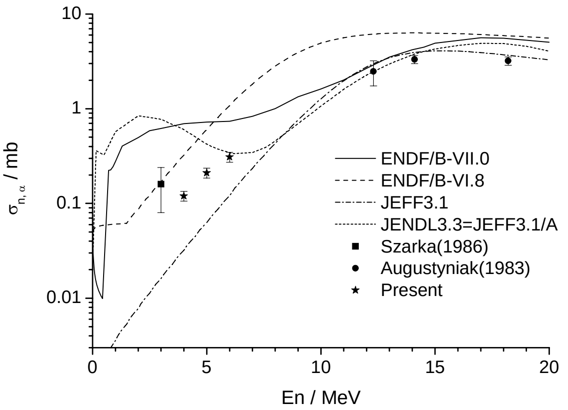


Fig. 5.Cross sections of ^{143}Nd(n,α)^{140}Ce r reaction

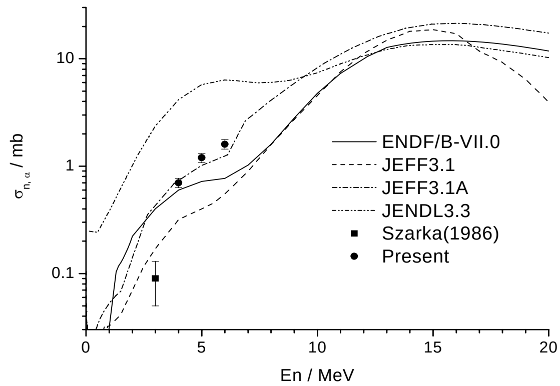


Fig. 6. Cross sections of ^{95}Mo(n, α)^{92}Zr reaction

3 Lanzhou University:

The following cross sections was measured at neutron energy from 13.5 to 14.8MeV at Lanzhou University by using the activation method :

^{51}V(n,p)^{51}Ti, Ni(n，x)$^{58(m+g)}$Co，^{64}Ni(n, α)^{61}Fe, Ni(n，x)^{6om}Co，Ni(n，x)^{61} Co ,Ni(n，x)^{62m}Co, ^{70}Ge (n, 2n) ^{69}Ge, ^{70}Ge (n, p) ^{70}Ga, ^{72}Ge(n, p) ^{72}Ga, ^{74}Ge (n, α) ^{71m}Zn, ^{74}Ge (n, p) ^{74}Ga, ^{76}Ge (n, 2n) ^{75}Ge, ^{82}Se(n, 2n)^{81m,g}Se, ^{76}Se(n, 2n)^{75}Se, ^{76}Se(n, p)^{76}As, ^{74}Se(n, p)^{74}As, ^{80}Se(n, α)^{77}Ge, ^{84}Sr(n, 2n)^{83}Sr, ^{86}Sr(n, 2n)^{85m}Sr, ^{86}Sr(n, 2n)^{85}Sr, ^{88}Sr(n, 2n)^{87m}Sr, ^{84}Sr(n, p)^{84}Rb, ^{86}Sr(n, p)^{86}Rb, ^{88}Sr(n, p)^{88}Rb, ^{88}Sr(n, α))^{85m}Kr, ^{89} Y (n, 2n) ^{88} Y, ^{89}Y(n, a) $^{86m+g}$Rb, ^{96}Ru(n,d*)^{95g}Tc, ^{110}Pd(n, α) ^{107}Ru, ^{108}Pd(n,p) ^{108}Rh ,^{128}Te(n,2n)^{127m}Te, ^{170}Yb(n,2n) ^{169}Yb, ^{172}Yb(n, p) ^{172}Tm, ^{173}Yb(n, p) ^{173}Tm, ^{174}Yb(n,p)^{174}Tm, ^{176}Yb(n,2n) ^{175}Yb, ^{165}Ho(n,2n)^{164g}Ho, ^{165}Ho(n,2n)^{164m}Ho, ^{165}Ho(n, α)^{162}Tb,^{180}W(n,2n)^{179}W, ^{186}W(n,2n)^{185m}W, ^{192}Os(n, 2n)^{191g}Os, ^{192}Os(n, 2n)^{191m}Os,^{186}Os(n, 2n)^{185}Os, ^{184}Os(n,2n)^{183g}Os, ^{184}Os(n ,2n)^{183m}Os, ^{189}Os(n, p)^{189}Re, ^{190}Os(n, α)^{187}W, ^{2O3}Tl(n 2n)^{202}Tl。

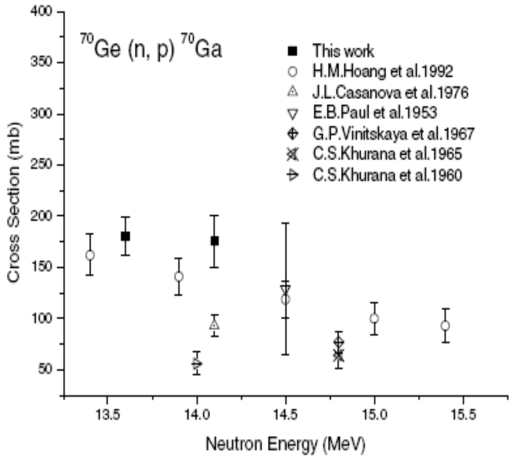


Fig.7 Cross sections of ^{70}Ge (n, p) ^{70}Ga, reaction

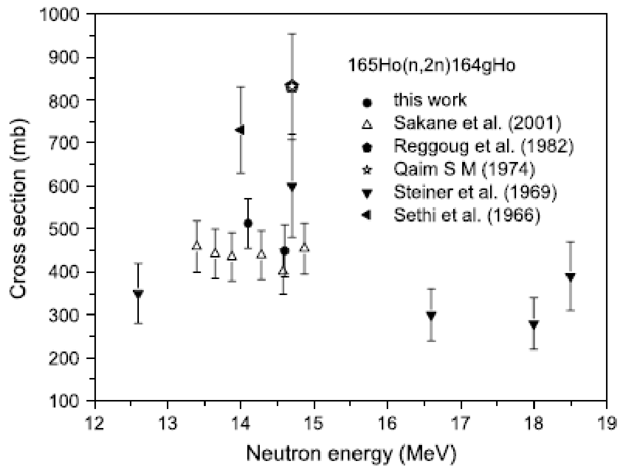


Fig.8 Cross sections of $^{165}Ho(n,2n)^{164g}Ho$ reaction

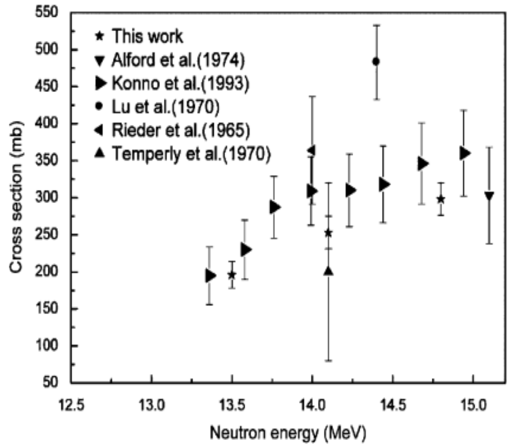


Fig.9 Cross sections of $^{96}Ru(n,d^{*})^{95g}Tc$ reaction

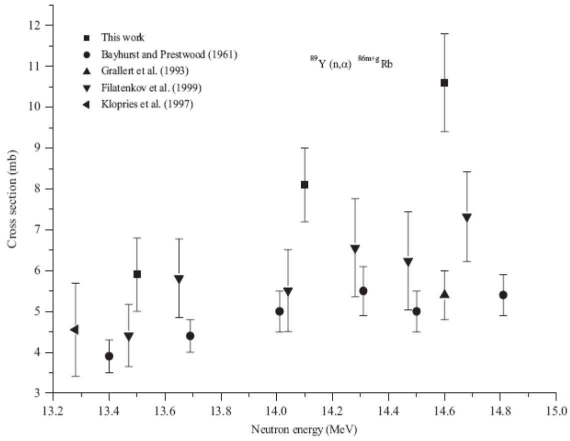
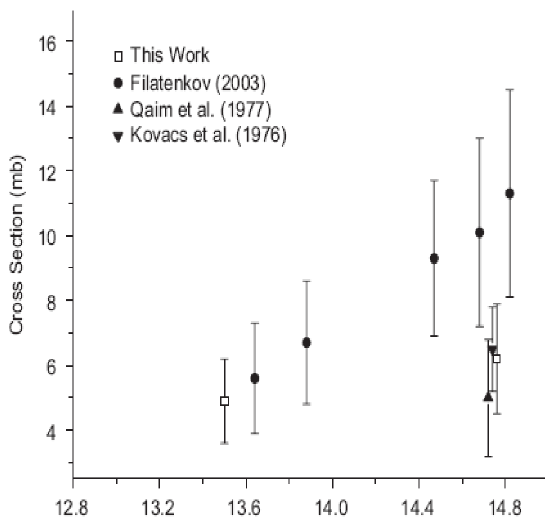
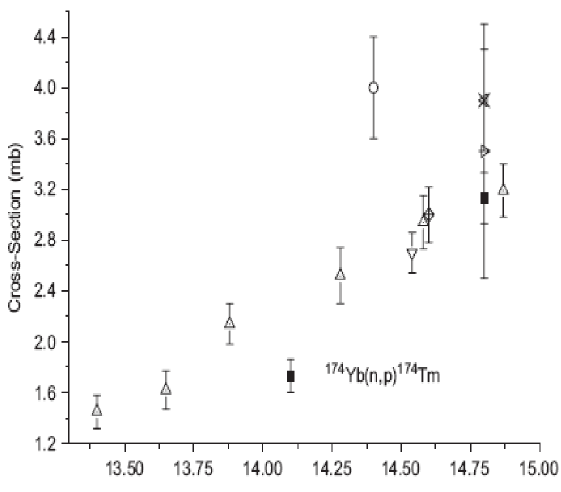


Fig.10 Cross sections of $^{89}Y(n, a)$ $^{86m+g}Rb$ reaction



Neutron Energy(MeV)

Fig.10 Cross sections of $^{190}Os(n, \alpha)^{187}W$ reaction



Neutron Energy(MeV)

Fig.11 Cross sections of $^{174}Yb(n, p)$ ^{174}Tm reaction

4 Sichuan University:

The cross sections for the $^{115}In(n,\gamma)^{116}In$, $^{116m}In(n,\gamma)^{117}In$, $^{71}Ga(n,\gamma)^{72}Ga$ and $^{174}Hf(n,\gamma)^{175}Hf$ reaction were measured in neutron energy range from 30 to 1500 keV in the past years.