A Study of neutron scattering from ^{232}Th for the energy range from 10-20 MeV using the Poschl-Teller potential.

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Introduction

Neutron scattering cross-sections on various materials has been methodically studied. In this paper we analysed various cross-sections, polarizations, angular distribution of n-Th scattering in the energy range of 10-20 Mev using the PT [1] Potential. Basically empirical estimates were carried out.

Analysis

We could establish the energy dependence of the total cross-section and the half width α. Essentially the potential used is

$$V_T = -V_r f(r) - iV_i f(r) - iW_s g(r) + l.sC_{so}V_{so}h(r)$$

The Solutions of the Schrödinger Equation was carried out using Fox-Goodwin method. Eventually phase shifts were evaluated, then the Scattering Matrix and the Transmission Co-efficient. There is almost an agreement in the Total cross-sections obtained from experimental works and other theories like optical model and calculations using the code TALYS. The Scattering Matrix is given in Fig 1., and the Transmission Co-efficient is shown in Fig 2.The Total Cross-Section is depicted in Fig 3. The parameters used in the model are shown in table 1, along with the values of χ^2. The variation of α with energy (E) is shown in table 2.

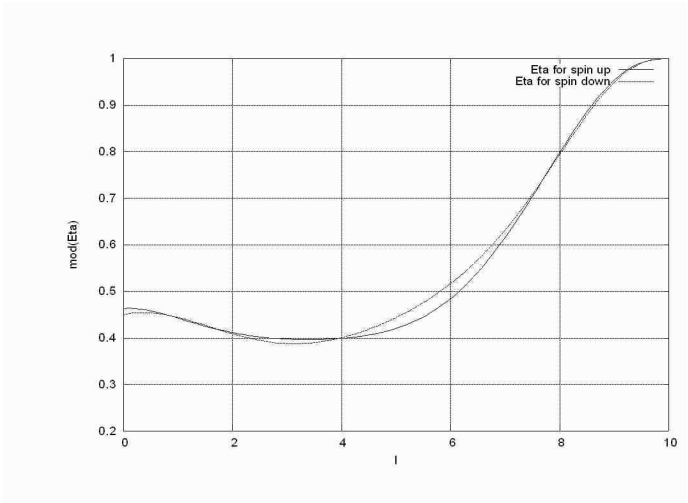

Fig2 : Scattering Matrix

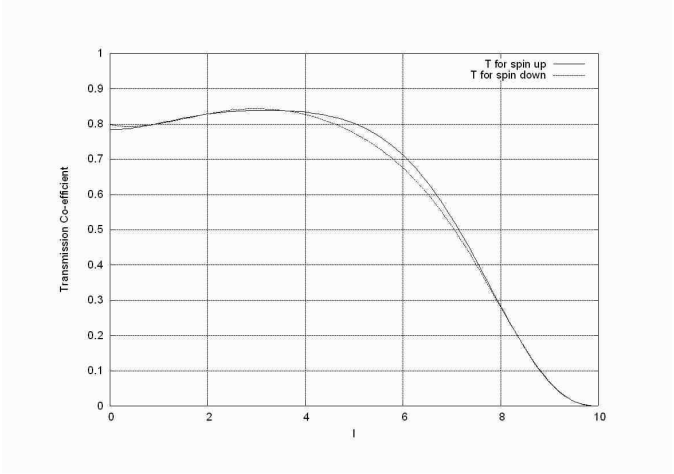

Fig2 : Transmission Co-efficient

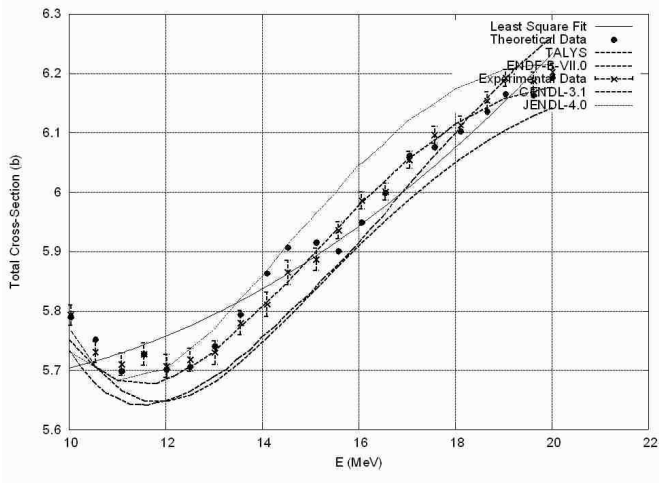

Fig 3 : Total cross-section of n + ^{232}Th

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Table 1: Parameters

E_{lab} MeV	V_0 MeV	W_0 MeV	W_{sd} MeV	V_{so} MeV	χ^2
10.55	39.0	0.1	0.626	6.4	0.287
12.02	38.0	0.22	0.694	6.4	0.016
13.02	37.4	0.28	0.730	6.4	0.057
14.10	37.3	0.30	0.730	6.4	1.352
15.12	36.6	0.35	0.630	6.4	0.445
18.11	35.8	1.80	0.580	6.4	0.114
19.62	35.0	2.70	0.510	6.4	0.719

Table 2 : α variation with energy

E_{lab} MeV	α
10.55	0.186
12.02	0.192
13.02	0.195
14.10	0.195
15.12	0.198
18.11	0.171
19.62	0.163

Conclusion

This gave us the motivation to calculate n-scattering with other common actinides used in ADS and to extend to higher energies up to 200 MeV in future, so that we can apply our work to the accelerator driven sub-critical (ADS) system.

Reference

1. SigefriedFlugge:“PracticalQuantumMechanics”1990.
2. Bersillon, O. “TheComputerCodeSCAT-2”, Proc.WorkshoponAppliedNuclearTheory andNuclearModelCalculationsforNuclearTechnology Applications, P.319, WordlScientific (1989).