^{2}H(n,n)

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	J. E. Purcell[#], C. G. Sheu[*]	NDS 130 1 (2015)	30-Jun-2015

Total cross section:

Fig. 1 in (1972St32) and Fig. 2 in (1973St35) show the measured total n-^{2}H cross section below E_n=1 MeV. From a peak value of about 3.4 b at zero energy (reported to be 3.390 b *12* in (1971Di15), it falls monotonically to about 2.9 b at 1 MeV. As Figs. 4, 5 and 6 in (1972Cl04) show, the total n-^{2}H cross section continues to fall monotonically as the neutron energy increases, dropping to about 1 b at 10 MeV and 0.6 b at 20 MeV. A summary of total n-^{2}H total cross sections for E_n=1 to 17 MeV is given in (1971Da07). Table 2.3.1a in (1975Fi08) lists more than 50 references related to total n-^{2}H cross sections for energies from thermal to near 300 GeV. Two additional references are given in (1987Ti07). Cross sections for thermal neutrons are reported in (1975Ca30) and from near zero to 20 MeV in (1980Ph01), along with total cross sections for neutrons on H and ^{3}H.

Scattering lengths:

Frequently quoted experimental values for the low energy doublet and quartet n+d scattering lengths are (1971Di15,1975Fi08,1987Ti07,1990Fr18,2003Wi08): $^{2}a_{nd}$=0.65 fm *4* and $^{4}a_{nd}$=6.35 fm *2*. Calculations related to n+d scattering and ^{3}H structure with various interactions, as noted in (2003Sc12), have resulted in a scattering of values of $^{2}a_{nd}$. In contrast, the values obtained for $^{4}a_{nd}$ tend to be nearly constant at around 6.34 fm. These authors used an average calculated value $^{4}a_{nd}$=6.346 fm *7* to deduce a value $^{2}a_{nd}$=0.645±0.003(exp)±0.007(theory) fm. This value of $^{2}a_{nd}$ has been used as input in calculations using three-body interactions; see (2006Pl09,2010Ki05).

Elastic scattering:

In Tables 2.3.1 b and 2.3.1 c of the first A=3 review (1975Fi08), there are over 60 publications reporting results from n+d elastic scattering, about 1/3 of which reported using polarized neutrons. Neutron energies ranged from less than 0.1 eV to over 150 MeV. Similarly, in the second A=3 review (1987Ti07), about 20 publications reported n+d elastic scattering results for neutron energies from 2 to 800 MeV, about 2/3 of which used polarized neutrons. In Table 3.2 of the third A=3 review, close to 40 publications are referenced that report n+d elastic scattering results. Most used polarized neutrons and some also used polarized targets. The neutron energies ranged from 11 meV to 250 MeV.

Elastic n+d scattering phase shifts for energies up to 24 MeV are shown in Fig. 14 of (1972Se23). However, see comments in (1975Fi08) as well as in (1987Ti07) on this subject.

A major issue in n+d scattering is the so-called analyzing power puzzle in which the calculated and measured values for the analyzing power A_y do not agree. This effect is also seen in p+d scattering as well. See (2008To20) for a discussion of the puzzle.

The following are publications dealing with n+d elastic scattering since the third A=3 review:

2010We01: Table 1 lists references studying n-d analyzing power for n-d scattering for neutron energies from 1.2 to 30 MeV with a gap between 16 and 30 MeV. Fig. 8 gives $A_y(\theta)$ results of this experiment plus calculation. The analyzing power puzzle is still present.

2011Fr11: Reports differential cross sections for both n+^{2}H and n+^{3}H elastic scattering at E_n=14.1 MeV.

2013Er02: Reports study of n+d elastic scattering for E_n=135-250 MeV.

2014We04: Reports measurements of analyzing power for n+d scattering at E_n=22.5 MeV. Results shown in Fig. 4 and corresponding discussion show that the analyzing power puzzle is still present.

2014Na25: Studied n+d scattering, E_n=0.1-2 MeV.