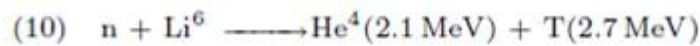


The cross sections used in TRANSP are theoretical cross-sections called “Duane Jarne”. The original reference is

- [1] DUANE, B.H., ‘Fusion cross section theory’, in Annual Report on CTR Technology 1972 (WOLKENHAUER, W.C., Ed.), Rep. BNWL-1685, Battelle Pacific Northwest Laboratory, Richland, WA (1972).

This is also available in the NRL formulary:



The total cross section in barns (1 barn =  $10^{-24} \text{ cm}^2$ ) as a function of  $E$ , the energy in keV of the incident particle [the first ion on the left side of Eqs. (1)–(5)], assuming the target ion at rest, can be fitted by<sup>28a</sup>

$$\sigma_T(E) = \frac{A_5 + [(A_4 - A_3 E)^2 + 1]^{-1} A_2}{E [\exp(A_1 E^{-1/2}) - 1]}$$

where the Duane coefficients  $A_j$  for the principal fusion reactions are as follows:

	D-D (1a)	D-D (1b)	D-T (2)	D-He <sup>3</sup> (3)	T-T (4)	T-He <sup>3</sup> (5a-c)
$A_1$	46.097	47.88	45.95	89.27	38.39	123.1
$A_2$	372	482	50200	25900	448	11250
$A_3$	$4.36 \times 10^{-4}$	$3.08 \times 10^{-4}$	$1.368 \times 10^{-2}$	$3.98 \times 10^{-3}$	$1.02 \times 10^{-3}$	0
$A_4$	1.220	1.177	1.076	1.297	2.09	0
$A_5$	0	0	409	647	0	0

The DD/DT cross-sections were upgraded to “Bosch-Hale”, but the TT cross-section was not.