

## LEXFOR “Fitting Coefficients” – LEG/RS0 and LEG/RSD

(N. Otsuka, 2020-12-24, Memo CP-D/1007)

**Note added to this Working Paper:**

Addition of the zero-th order coefficient is proposed to the formulae of LEG/RS0 and LEG/RSD in LEXFOR “Fitting Coefficients”.

LEXFOR “Fitting Coefficients” defines  $DA_{,,LEG/RS0}$  and  $DA_{,,LEG/RSD}$  as follows:

$DA_{,,LEG/RS0} = B_l$  (units NO-DIM) where:

$$\frac{d\sigma}{d\Omega}(E, \theta) = \frac{d\sigma}{d\Omega}(E, 0^\circ) \sum_{l=1}^n a_l(E) P_l(\cos \theta)$$

$DA_{,,LEG/RSD} = B_l$  (units NO-DIM) where:

$$\frac{d\sigma}{d\Omega}(E, \theta) = \frac{d\sigma}{d\Omega}(E, 90^\circ) \sum_{l=1}^n a_l(E) P_l(\cos \theta)$$

Due to absence of the  $l=0$  term, the integration of the right-hand side over the whole solid angle gives zero. This is strange! I found they were defined differently in an old LEXFOR entry (IAEA-NDS-3 Rev.96/11):

$DA_{,,LEG/RS0} = a_l$  (no dimension) where:

$$\frac{d\sigma}{d\Omega}(E, \theta) = \frac{d\sigma}{d\Omega}(E, 0^\circ) \sum_{l=0}^n a_l(E) P_l(\cos \theta)$$

$DA_{,,LEG/RSD} = a_l$  (no dimension) where:

$$\frac{d\sigma}{d\Omega}(E, \theta) = \frac{d\sigma}{d\Omega}(E, 90^\circ) \left[ 1 + \sum_{l=1}^n a_l(E) P_l(\cos \theta) \right]$$

For  $DA_{,,LEG/RSD}$ , however, I do not see a reason to fix the 0th order term to 1 (*i.e.*, the angular integrated cross section is not necessary to be  $4\pi$  times the 90 deg angular differential cross section in general.). I propose the following definitions:

$DA_{,,LEG/RS0} = a_l$  (units NO-DIM) where:

$$\frac{d\sigma}{d\Omega}(E, \theta) = \frac{d\sigma}{d\Omega}(E, 0^\circ) \left[ a_0 + \sum_{l=1}^n a_l(E) P_l(\cos \theta) \right]$$

$DA_{,,LEG/RSD} = a_l$  (units NO-DIM) where:

$$\frac{d\sigma}{d\Omega}(E, \theta) = \frac{d\sigma}{d\Omega}(E, 90^\circ) \left[ a_0 + \sum_{l=1}^n a_l(E) P_l(\cos \theta) \right]$$

There are many data sets compiled with one of these quantities without the 0th order coefficient, and they are suspicious. I checked such questionable entries and found that LEG/RS0 or LEG/RSD are often wrongly used for the coefficients for the expansion  $W(\theta)=1+a_1P_1+a_2P_2+\dots$  which must be coded with LEG/RS. Below is a summary from my quick review, and the originating centre is asked to check each case against the source article before correction and retransmission.

SF8 must be LEG/RS.

41027.003, 41136.003, 41140.004, 41615.004, 41660.002+004, 41684.002-003, 41685.005+006, A1156.008+009, A1358.004, C1361.004, C1499.0004-005, F0216.004, F0360.005, F0397.003+005, F0475.002, M0283.013-022, O1347.004.

SF8 must be probably LEG/RS (though the expansion formula is not given in the article or wrong).

40354.003, A1357.004, M0879.003-004

SF8 must be RSD.

41616.008-011

SF8 must be COS/RS.

F0013.004

Not clear

23411.002-003, 30455.003, 40449.002, O1195.004