MEMO CP-C/76

Date: August 19, 1980

From: T.W. Burrows & V. McLane VM

Subject: Fitting Coefficients

References: CP-C/75
action of the 4th NRDC Meeting.

Attached is a proposal for additions to the LEXFOR entry on Fitting Coefficients.

Following are the dictionary additions required for this proposal. Please note that the modifiers described in this proposal have already been added to Dictionary 34.

Dictionary 25

(MB/SR)2 MILLIBARNS SQUARED PER STERADIAN SQUARED.

Sol Pearlstein

lh

Distribution:
H. Behrens
F.E. Chukreev
G. Dearnaley
V. Manokhin
A. Marcinkowski
H. Muenzel
S. Pearlstein
J.J. Schmidt
H. Tanaka
N. Tubbs
NNDC

cc. D. Cullen
N. DayDay
H. Hendrickson
M. Lammer
H. D. Lemmel
K. Okamoto
V. Poonyaev
J. J. Schmidt
O. Schwerer
T. Seito

Fitting Coefficients

Coefficients obtained from a fit to a differential cross section may be coded into EXFOR by entering the type of expansion used to fit the data in REACTION SF8 and specifying the representation used.

The data for a given energy is entered with the coefficient number given under the data heading NUMBER or NUMBER-CM (compare Center-of-Mass System).

Note: If the directly measured differential cross sections are also coded in EXFOR, the coefficients should be marked as dependent data under STATUS, with a cross-reference to the subentry number of the cross section from which they were derived.

References:

1. M.Abramowitz and I.A.Stegun, Handbook of Mathematical Functions, Dover Publications, 1970.

Expansions to be coded into EXFOR

1. Cosine Coefficients

Definition: Coefficients obtained by fitting a differential cross section by an equation containing a sum in powers of cosine.

Quantity Codes: COS in REACTION SF8 plus a code indicating the representation used.

Representations:

DA,,COS = a_ℓ (dimension, e.g., b/sr) where:

$$\frac{d\sigma}{d\Omega}(E,\Theta) = a_o + \sum_\ell a_\ell(E)\cos^\ell\Theta$$

DA,,COS/RS = a_ℓ (no dimension) where:

$$\frac{d\sigma}{d\Omega}(E,\Theta) = \frac{\sigma}{4\pi}\left[1 + \sum_\ell a_\ell(E)\cos^\ell\Theta\right]$$

DA,,COS/RSO = a_ℓ (no dimension where:

$$\frac{d\sigma}{d\Omega}(E,\Theta) = \frac{d\sigma}{d\Omega}(E,0^o)\sum_\ell a_\ell(E)\cos^\ell\Theta$$

DA,,COS/1K2 = a_ℓ (no dimension) where:

$$\frac{d\sigma}{d\Omega}(E,\Theta) = \frac{1}{k^2}\sum_\ell a_\ell(E)\cos^\ell\Theta \; *$$

* k = wave number

2. Legendre Coefficients

Definition: Coefficients obtained by fitting a differential cross section by an equation containing a sum of Legendre polynomials.

Quantity Codes: LEG in REACTION SF8 plus a code indicating the exact representation used.

Representations:

DA,,LEG = A_ℓ (dimension, e.g., b/sr) where:

$$\frac{d\sigma}{d\Omega}(E,\Theta) = a_o(E) + \sum_\ell a_\ell(E)\, P_\ell\, (\cos\Theta)$$

DA,,LEG/RS = w_ℓ (no dimension) where:

$$\frac{d\sigma}{d\Omega}(E,\Theta) = \frac{\sigma}{4\pi}\left[1 + \sum_\ell w_\ell(E)\, P_\ell\, (\cos\Theta)\right]$$

DA,,LEG/RSL = B_ℓ (no dimension) where:

$$\frac{d\sigma}{d\Omega}(E,\Theta) = \frac{\sigma}{4\pi}\left[1 + \sum_\ell (2\ell+1)\, B_\ell(E)\, P_\ell\, (\cos\Theta)\right]$$

DA,,LEG/2L2 = a_ℓ (dimension, e.g., b/sr) where:

$$\frac{d\sigma}{d\Omega}(E,\Theta) = \frac{1}{2}\sum_\ell (2\ell+1)\, a_\ell(E)\, P_\ell\, (\cos\Theta)$$

DA,,LEG/L4P = a_ℓ (dimension, e.g., b/sr) where:

$$\frac{d\sigma}{d\Omega}(E,\Theta) = \frac{1}{4\pi}\sum_\ell (2\ell+1)\, a_\ell(E)\, P_\ell\, (\cos\Theta)$$

DA,,LEG/1K2 = a_ℓ (no dimension) where:

$$\frac{d\sigma}{d\Omega}(E,\Theta) = \frac{1}{k^2}\sum_\ell a_\ell(E)\, P_\ell\, (\cos\Theta)^*$$

* k = wave number

3. Associated Legendre Polynomials of the First Kind

Definition: Coefficients obtained by fitting

- a differential cross section
- or the product of a differential polarization and a differential cross section
- or the product of a differential polarization and the square of a differential cross section

by an equation containing a sum of associated Legendre polynomials of the first kind (see, for example, Chapter 8 of Reference 1 for the relationship between Legendre functions). See also Polarization.

Quantity Codes: AL1 in REACTION SF8.

Examples:

FM/DA,,AL1 = a_ℓ (dimension, e.g., b/sr) where:

$$P(E,\theta) \times \frac{d\sigma}{d\Omega} = \sum_\ell a_\ell P_\ell^1 (\cos\theta)$$

FM2/DA,,AL1 = a_ℓ (dimension, e.g., (mb/sr)) where:

$$P(E,\theta) \times \frac{d\sigma^2}{d\Omega}(E,\theta) = \sum_\ell a_\ell(E) P_\ell^1 (\cos\theta)$$

4. Sine-Squared Coefficients

Definition: Coefficients obtained by fitting

- a differential cross section
- or the product of a differential polarization and a differential cross section
- or the product of a differential polarization and the square of a differential cross section

by an equation containing a sum in powers of sine . See also Polarization.

Quantity Codes: SN2 in REACTION SF8.

Examples:

FM/DA,,SN2 = a_ℓ (dimension, e.g., b/sr) where:

$$P(E,\theta) \times \frac{d\sigma}{d\Omega}(E,\theta) = \sum_\ell a_\ell \sin^{2\ell}\theta$$

FM2/DA,,SN2 = a_ℓ (dimension, e.g., (mb/sr)) where:

$$P(E,\theta) \times \frac{d\sigma^2}{d\Omega}(E,\theta) = \sum_\ell a_\ell(E) \sin^{2\ell}\theta$$