ELASTIC DEUTERON SCATTERING AND OPTICAL MODEL PARAMETERS AT ENERGIES UP TO 100 MeV

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The phenomenological optical potential, U, is defined as

$$U(r,E) = -V_V(r,E) - iW_V(r,E) + iW_D(r,E) + V_{SO}(r,E)(\vec{l}\cdot\vec{s}) + V_C(r), \tag{0.1}$$

where $V_{V,SO}$ and $W_{V,D}$ are the real and imaginary components of the volume-central (V), surface-central (D) and spin-orbit (SO) potentials, respectively. E is the laboratory energy of the incident particle in MeV. All components are separated in E-dependent well depths, V_V, W_V, W_D, and V_{SO}, and energy-independent radial parts f, namely

$$\begin{aligned} V_V(r,E) &= V_V(E) f(r,R_V,a_V), \\ W_V(r,E) &= W_V(E) f(r,R_W,a_W), \\ W_D(r,E) &= -4a_W W_D(E)\frac{d}{dr} f(r,R_W,a_W), \\ V_{SO}(r,E) &= V_{SO}(E)\left(\frac{\hbar}{m_\pi c}\right)^2 \frac{1}{r}\frac{d}{dr} f(r,R_{SO},a_{SO}). \end{aligned} \tag{0.2}$$

As usual, the form factor $f(r,R_i,a_i)$ is a Woods–Saxon shape

$$f(r,R,a) = \left(1+\exp\left[(r-R_i)/a_i\right]\right)^{-1}, \tag{0.3}$$

where, with A being the atomic mass number, the geometry parameters are the radius $R_i = r_i A^{1/3}$ and the diffuseness parameters a_i. For charged projectiles, the Coulomb term V_C, as usual, is given by that of a uniformly charged sphere

$$V_C(r) = \begin{cases} \dfrac{Zze^2}{2R_C}\left(3 - \dfrac{r^2}{R_C^2}\right), & \text{for } r \le R_C, \\ \dfrac{Zze^2}{r}, & \text{for } r > R_C, \end{cases} \tag{0.4}$$

with $Z(z)$ the charge of the target (projectile), and $R_C = r_C A^{1/3}$ the Coulomb radius.

^{2}H OMP parameterization

The global deuteron OMP for $50 \le E \le 100$ MeV and $20 \le A \le 208$ is given by the following formulas.

Real central potential:

$$V_V = 81.32 - 0.24E + 1.34\frac{Z}{A^{1/3}} \text{ MeV},$$
$$R_V = 1.18A^{1/3} \text{ fm},$$
$$a_V = 0.636 + 0.035A^{1/3} \text{ fm},$$

Imaginary central potential:

$$W_V = \begin{cases} 0, \text{ for } E < 45 \text{ MeV} \\ 0.132(E-45) \text{ MeV, for } E > 45 \text{ MeV} \end{cases}$$
$$W_D = 7.35 + 1.15A^{1/3} - 0.712W_V \text{ MeV},$$
$$R_W = 1.27A^{1/3} \text{ fm},$$
$$a_W = 0.768 + 0.021A^{1/3} \text{ fm},$$

Coulomb potential radius:

$$R_C = 1.3A^{1/3} \text{ fm}.$$

Spin-orbit potential (it is **not used** at the moment in the NRV OMP-code):

$$V_{SO} = 6 \text{ MeV},$$
$$R_{SO} = 1.0A^{1/3} \text{ fm},$$
$$a_{SO} = 1.0 \text{ fm}.$$