Average local polarisation potential

We can define a complex "weighted mean" local polarisation potential $V^P(R)$ [1]

$$V^P(R) = \frac{\sum_J w_J(R) V_J^{TE}(R)}{\sum_J w_J(R)}, \tag{1}$$

where $V_J^{TE}(R)$ are the "trivially equivalent potentials" defined by

$$V_J^{TE}(R) = \frac{1}{f_{g.s,J}(R)} \sum_{\alpha' \neq g.s} V^J_{g.s:\alpha'}(R) f_{\alpha',J}(R), \tag{2}$$

and $w_J(R)$ are weight factors chosen as

$$w_J(R) = a_J \mid f_{g.s,J}(R) \mid^2, \tag{3}$$

for some coefficients a_J to be specified. This choice of weight factors $w_J(R)$ avoids singularities when $f_{g.s,J}(R)$ has a node in some R. The coefficients a_J are considered as proportional to partial reaction cross sections

$$a_J = (2J+1)(1- \mid S_J \mid^2), \tag{4}$$

where S_J are the elastic S-matrix elements for each J value. A single channel calculation (elastic channel) using the sum of "$V^J_{g.s:g.s}(R) + V^P(R)$" should approximately reproduce the elastic scattering [1]) cross sections.

[1] I.J. Thompson, M.A. Nagarajan, J.S. Lilley and M.J. Smithson, Nucl. Phys. A 505 (1989) 84.