II.B.3. Breit-Wigner Approximation

In addition to the preferred Reich-Moore formalism, SAMMY also offers the option to calculate cross sections using either the multilevel Breit-Wigner (MLBW) or the single-level Breit-Wigner (SLBW) [GB36]. This has the advantage that the calculation occurs more rapidly because fewer computations are required; however, it also has the disadvantage that unphysical cross sections may be generated. Use of this option is discouraged for new analyses; the option is included within SAMMY for completeness' sake, to permit use of SAMMY with most ENDF resonance parameter information, and to facilitate comparisons with older codes such as SIOB [GD78].

Formulae for MLBW and SLBW cross sections are presented in Section II.B.3.a; these are identical to those used in ENDF files [ENDF-102], although they are not necessarily programmed in this fashion. Formulae for derivatives are given in Section II.D.2.

The reader should be aware that the ENDF version of MLBW (and hence, SAMMY's version of MLBW) does not correspond to the usual definition of multilevel Breit Wigner. Instead, only the elastic cross section is calculated with the multilevel formula; other partial cross sections for the MLBW format are actually *single*-level.

A note regarding broadening: Historically, the Breit-Wigner formulations had the great advantage that the cross sections could be Doppler broadened analytically, using the high-energy approximation to the free-gas model of Doppler broadening (Section III.B.3). Results were written in terms of χ and ψ functions, and computation was relatively rapid. However, with the advent of modern computers, more accurate cross sections and more accurate Doppler-broadening computations can be accomplished rapidly, without resorting to these rather crude approximations. In SAMMY, Doppler and resolution broadening are accomplished numerically, in the same manner for MLBW and SLBW cross sections as for Reich-Moore cross sections, as described in Section III of this manual.