Statistical Modelling of Resonant Cross Section Structure in URR, Model of the Characteristic Function

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A statistical model for the resonant cross section structure in the Unresolved Resonance Region has been developed in the framework of the R-matrix formalism in Reich Moore approach with effective accounting of the resonance parameters fluctuations [1]. The model uses only the average resonance parameters and can be effectively applied for analyses of cross sections functional, averaged over many resonances. Those are cross section moments, transmission and self-indication functions measured through thick sample. In this statistical model the resonant cross sections structure is accepted to be periodic and the R-matrix is a function of $\varepsilon = E / D$ with period $0 \le \varepsilon \le N$;

$$R_{nc}(\varepsilon) = \frac{\pi}{2}\sqrt{S_n S_c}\,\frac{1}{N}\sum_{\lambda=1}^{N}\beta_{\lambda n}\beta_{\lambda c}\,ctg[\pi(\varepsilon_\lambda - \varepsilon - iS_\gamma)/N];$$

Here S_n, S_c, S_γ is respectively neutron strength function, strength function for fission or inelastic channel and strength function for radiative capture, N is the number of resonances $(\varepsilon_\lambda, \beta_\lambda)$ that obey the statistic of Porter-Thomas and Wigner's one.

The simple case of this statistical model concerns the resonant cross section structure for non-fissile nuclei under the threshold for inelastic scattering – the model of the characteristic function with HARFOR program [2].

In the above model some improvements of calculation of the phases and logarithmic derivatives of neutron channels have been done [3]. In the parameterization we use the free parameter R_l^∞, which accounts the influence of long-distant resonances.

The above scheme for statistical modelling of the resonant cross section structure has been applied for evaluation of experimental data for total, capture and inelastic cross sections for ^{232}Th in the URR (4-150) keV and also the transmission and self-indication functions in (4-175) keV. The set of evaluated average resonance parameters have been obtained. The evaluated average resonance parameters in the URR are consistent with those in the Resolved Resonance Region (CRP for Th-U cycle, Vienna, February, 2006).

[1] A.A.Lukyanov, Structure of Resonance Cross Sections, Atomizdat, Moscou,1978
[2] N.Koyumdjieva, N.Janeva and K.Volev, *NSE* **137(2)** 194 (2001)
[3] N.Janeva,PROGRESS REPORT on the Research Contract № 12414/RO, Febr. ,2006