Theoretical Evaluation of Neutron-nucleus Scattering Parameters from Experimental Data in the $6 \leq A < 60$ Mass Region

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Systematic calculations of the neutron-nucleus scattering parameters at several neutron energies $E_i < 2$ keV have been performed for 37 isotopes ($^6$Li, . . . , $^{59}$Co) in the mass region of $6 \leq A < 60$, using the large compilation of experimental neutron-nucleus scattering data obtained in Garching. In the first stage of these calculations, the $s$-wave potential scattering radius $R_0$, the scattering lengths $b_{\text{coh}}$, $b_{\gamma}$, and the bound state parameters $(E_b, \Gamma_r, \Gamma_n, g I_n^0)$ have been calculated for each isotope, employing the general least squares fit (GLSQF) for the experimental and the corresponding theoretical values of the total neutron-nucleus cross sections $\sigma_{\text{tot}}(E_i)$ at several energies $E_i$, absorption cross sections $\sigma_{\text{abs}}(E_0)$ and of the coherent scattering lengths $b_{\text{coh}}$. The theoretical expressions for these parameters were deduced on the basis of the usual $S$-matrix formalism with no assumption about the particular shape of the optical model potential. In the second stage of our calculations, the spherical Fiedeldey-Frahn optical potential was employed for the pure theoretical description or the above mentioned neutron-nucleus scattering characteristics. The results obtained have been analyzed and compared with the values deduced from measurements.

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