PHENOMENOLOGICAL DESCRIPTION OF THE COULOMB ENERGIES FOR MEDIUM-HEAVY AND SUPERHEAVY NUCLEI

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Coulomb energy $E_C(A, Z)$ – is one of the main characteristics of the nucleus, determining its binding energy. In the experiment, may determine the difference of the Coulomb energies of neighboring nuclei isobars:

$$\Delta E_C(A, Z) = E_C(A, Z+1) - E_C(A, Z),$$

which is obtained from the simple relations [1] of the analog resonances energies measurements in charge-exchange reactions. For the Coulomb displacement energies $\Delta E_C(A, Z)$ systematic several approaches were used. First, is a relation:

$$\Delta E_C(A, Z) = a_T\,(Z + 0.5)A^{-1/3}\,f(A) + b_T \quad \text{(MeV)}, \tag{2}$$

where $f(A)$ is radius correction function. For $f(A) = 1$ the relation (2) goes into the semi-empirical Jänecke formula [2] parameterized by Anderson, C. Wong and McClure [3]. These parameters were determined from experimental data many times in different approaches [4]. In this paper we use the new database for more than 400 nuclei and focuses on medium-heavy nuclei. Approximation accuracy is not worse than 100 keV that is better than calculations within microscopic theory [5].

In this paper also analyzes the group theory approach to the description of the Coulomb energies of medium-heavy nuclei in the framework of $SU(4)$ symmetry. In [6] were obtained for the parameters of the theory for nuclei up to $A = 60$. We analyzed heavier nuclei up to $A = 244$. For heavy nuclei region deformation is taken into account, which strongly affects the ΔE_C value.

Approximation of Coulomb displacement energy ΔE_C was interpolated for superheavy nuclei (SHN), where is no experimental data. Deformation was taken into account with the predicted parameters β_2 and were considered only SHN, located on the line of beta-stability. Note that for heavy nuclei $SU(4)$-symmetry should be restored [7] and analysis of ΔE_C values was conducted in two approaches.

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1. J.Jänecke, F.D.Becchetti, A.M.VanDenBerg, *et al.* // Nucl. Phys. A. 1991. V.526. P.1.
2. J.Jänecke // Z. Physik. 1960. V.160. P.171.
3. J.D.Anderson, C.Wong, J.W.McClure // Phys. Rev. B. 1965. V.138. P. 615.
4. L.Zamick *et al.* // Phys. Rev. C. 2013. V.87. 067302.
5. Yu.V.Gaponov, Yu.S.Lutostansky // Sov. J. Nucl. Phys. 1972. V.16. P.270.
6. D.M.Vladimirov, N.B.Shul'gina // J. Nucl. Phys. 1987. V.45. P.1586.
7. Yu.V.Gaponov, Yu.S.Lyutostanskii // JETP Lett. 1973. V.18. P.75.