Fine and Superfine Structures in Neutron Resonance Positions

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Parameters of fine and superfine structures were introduced empirically in 1971 [1] from the analysis of maxima in distributios of neutron resonance positions, nuclear excitations and binding energies of wide range of nuclei. Recently, particle masses distributions were added [2]. Some maxima values were noticed to be in relations close to the QED radiative correction to the magnetic moment of the electron $\alpha/2\pi = 115.9 \cdot 10^{-5}$ applied to the electron mass. This value is of a fundamental character and reflects the influence of the physical condesate, vacuum [3].

$$\alpha/2\pi = 115.9 \cdot 10^{-5} = \varepsilon'' : \varepsilon' = \varepsilon' : 2m_e = m_e : M_q = m_\mu : M_Z = M_q : 3M_{H^\circ}. \quad (1)$$

In this equation (1) there are parameters of superfine and fine structures ε''=1.34 eV and ε'=1.2 keV, as well as the constituent quark mass M_q, Z boson mass M_Z and the scalar boson mass M_{H°=125 GeV.

A large amount of information on neutron resonances of heavy nuclei with Z=90-96 allows us to perform the analysis of the levels positions and spacings to check the distinguishing character of the superfine structure parameter. There is a system of stable energy intervals that are multiples of each other [4]. The superfine structure parameter ε''=1.34 eV was found in spacing distribution of neutron resonances of compound nucleus ^{238}Np: maximum at 1.1 eV. This value is close to the position of the first strong resonance at E_n=1.321 eV in this nucleus. The next strong resonance at E_n=5.777 eV is four times larger than the position of the first strong resonance and is close to the parameter 5.5 eV observed in even-even target nuclei of U: 5.98 eV ^{232}U, 5.1570 eV ^{234}U, 5.45 eV ^{236}U [5]. The intervals 5.5 eV=4ε'' and ε', as well as intervals that are multiples of them, were found in many heavy nuclei as maxima in spacings distributions of neutron resonances.

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