Contribution ID: **438** Type: **Oral talk (15 min + 5 min questions)**

NUCLEAR DATA AND THE STANDARD MODEL PARAMETRS

Friday, 15 July 2022 18:10 (20 minutes)

We consider fundamental aspects of nuclear physics and particle mass spectrum. The Standard Model with representation: SU(3)col × SU(2)L × U(1)Y [1] is the basic theory of all interactions. The Nonrelativistic Constituent Quark Model is a part of hadronic physics - an important component of the Standard model. The main NRCQM parameters are the pion mass mπ = 140 MeV, the initial constituent quark mass Mq = mΞ / 3 = me(α/2π)-1 = 441 MeV, introduced as "gammon" by P. Kropotkin, and the standard estimate of the constituent quark mass Mωq = mω/2 = 391 MeV, were recently confirmed by the observation of the exact representation of the nucleon masses by integers me and an additional shift dm = k (δmN/8) with k = 1 and k = 9 for neutron and proton, respectively (CODATA relations [1] with δmN = mn - mp):
mn = 115•16me - me - δmN/8; mp = 115•16me - me - 9(δmN/8); dmπ = (α/2π)mπ.
These relations contain integer representation of particle masses with a period 16me=δ: mμ=13δ - me, mπ=17δ + me, Mωq = 3•16δ = 48δ, Mq= 3•18δ = 54δ.
The QED radiative correction α/2π =116•10-5 (together with fermion masses) is an important parameter of the Standard model and is responsible for the influence of physical vacuum on the magnetic moment and particle mass [1,2].
Stable nuclear intervals 161 keV=δmN/8, 1293 keV= δmN and 3067 keV= 6me were found as maxima in independent spacing distributions in many nuclei. The interval 3067 keV / 2 = 3me is close to md / 3 (md = 4670(48) keV). The mass of c-quark mc=1270(20) MeV is close to 9mπ, and the mass of b-quark mb=4180(30) MeV is close to 9Mq. The analysis of particle masses and nonstatistical effects in nuclear data, carried out in the 1960s, showed the coincidence of the ratios between the electron mass me (the main parameter of the Standard model) and the mass of the constituent quark Mq with QED radiative correction α/2π = 115.96•10-5. Simultaneously, the same relationship was found empirically between the stable intervals of fine (ε' = 1.2 eV) and hyperfine (ε" = 1.34 eV = 5.5 eV/4) structures in neutron resonances and nuclear levels in the works of IAE and ITEP (under the direction of I. V. Kurchatov and A.I. Alikhanov). In this paper, we show confirmation of the dimensionless ratio, close to the QED radiative correction, in modern high-precision data on neutron resonances 232Th, 234U, 238U and 240-242Pu [3]. Correlation analysis of nuclear data provides independent confirmation of integer relations in parameters of Standard model, a theory of all interactions.

1. S.I. Sukhoruchkin, Nucl. Part. Phys. Proc. 312-317, 185 (2021).
2. V. Belokurov, D. Shirkov, Theory of Part. Interacions. AIP (1991).
3. S.I. Sukhoruchkin, Z.N. Soroko, D.S. Sukhoruchkin and M.S. Sukhoruchkina,. Proc. ISINN-28, Dubna, 2021. JINR E3-2021-48, pp. 234, 247, 259.

The speaker is a student or young scientist

No

Section

1. Nuclear structure: theory and experiment

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Session Classification: Nuclear structure: theory and experiment