MANIFESTATION OF ELECTRODYNAMICS PARAMETERS IN ENERGIES OF NUCLEAR STATES AND IN PARTICLE MASSES

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Conclusion about the existence of distinguished intervals multiple by the value of the electron rest mass m_e was drown in [1] from the analysis of correlations in distribution of nucleon separation energies and excitations of a wide range of nuclei. This fact was matched up to multiplicity to m_e of electromagnetic mass difference of pions ($9\,m_e$), of muon masses ($m_\mu = 23\cdot 9m_e = 13\cdot 16m_e - m_e$) and of a charged pion mass ($m_\pi = 17\cdot 16m_e + m_e$). Nearness of values of barionic masses to the rational numbers n of period 139 — — 140 *MeV*, close to m_π is shown in fig.1. There was pointed out closness to the parameter $\alpha/2\pi$ of dimensionless ratio of the interval of fine structure in proton and neutron resonances of light nuclei $\varepsilon' = 1.16 \pm 0.1$ *keV* and interval $\varepsilon_0 = 2m_e$ distinguishing in nuclear excitations and nucleon separation energies. Maxima which are close to ε_0 and $\varepsilon_0/2$ on ideohistogramms of spacing distribution $D = E_i^x - E_j^x$ for a number of near-magic nuclei are shown in fig.2.

In the present work the constancy of a scale factor was checked comparing equidistancy ($n = 5,6,7$) of the intervals $D = 1437, 1723, 2007$ *eV* in neutron resonances of even-odd target nuclei with $Z = 48$—54 ($J = 1/2^+$) and multiplicity of values of 0^+ excitations (again for $n = 5,6,7$) in cadmium isotopes ($N = 60$ — 64, $E^x = 1721,1473,1224$ *keV*). The similar scale factor was found for the distinguished interval D=1500 *eV* in neutron levels of A-even hafnium isotopes and $E^x = 1293$ *keV* $= D_0$ of 0^+ exitation of ^{176}Hf. The more accurate value $(115.9 \pm 0.1)\cdot 10^{-5}$ of this factor was deduced from the four above-mentioned pairs of the intervals (see Part 1 in the Table and fig.3).

In [2] the additional analysis of correlations with electrodynamics parameters was carried out. A number of relations in the particle masses turned out to be close to the value $\alpha/2\pi$ of polarization corrections of electrodynamics (see Parts 2,3,4 in the Table): 1) ratio of m_μ to the vector boson mass m_μ/M_z, 2) ratio of m_e to the estimate of constituent quark mass M_q $m_e/M_q = 2m_e/3(M_\Delta^0 - M_n)$, 3) ratio of electromagnetic mass difference of nucleon (D_0) to Λ - hyperon mass D_0/M_Λ. Relative values of mass diviations of muon, neutron (Δm_n) and Δm_π (electromagnetic mass difference of pions) from rational number of m_e are shown in Parts 5,6,7 of the Table ($\Delta m_n = D_0/8$ is given relatively to a pion mass). Part 3 presents relative value of

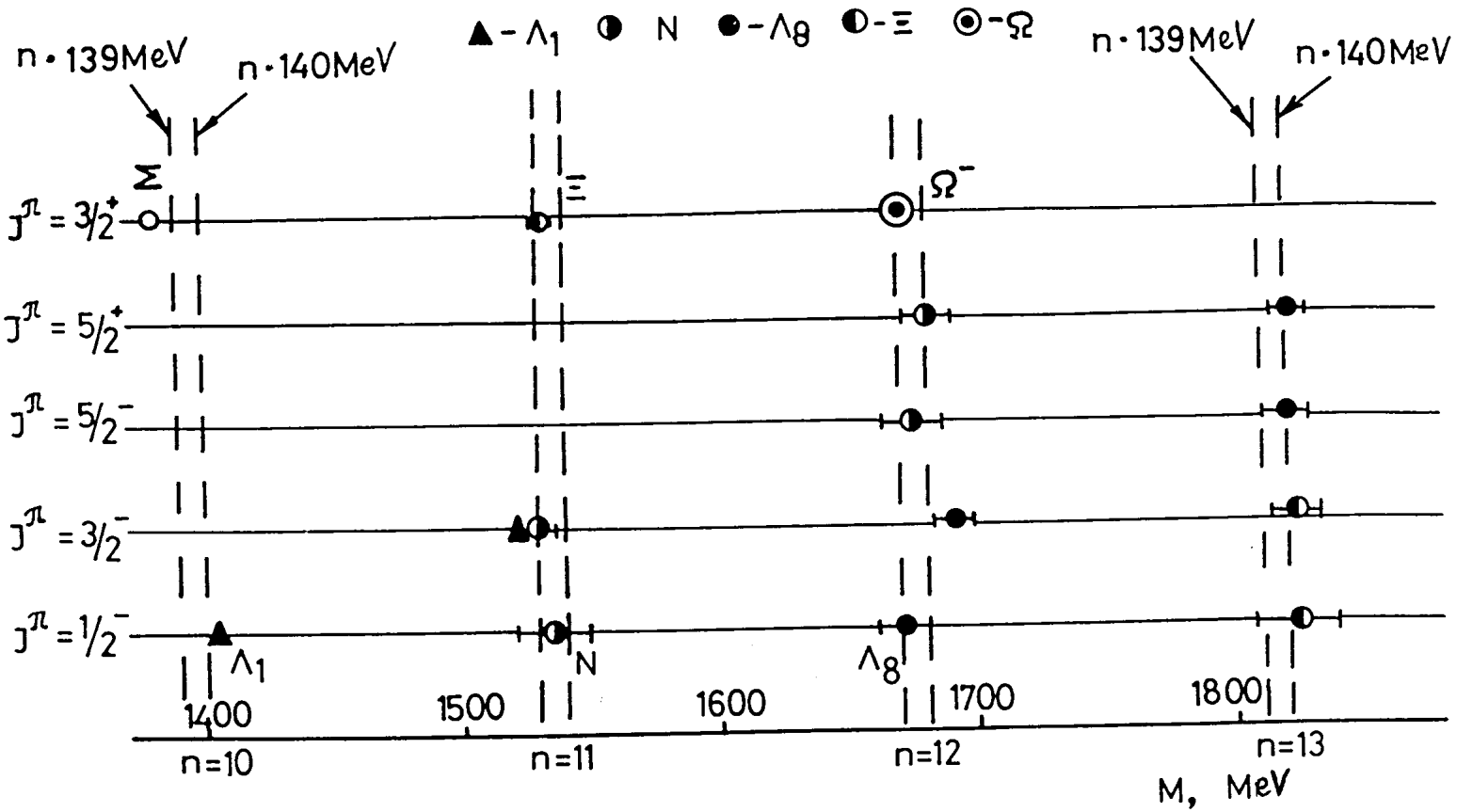

Fig.1. Nearness of barionic masses values to rational numbers of period 139—140 *MeV*, close to m_π=139.567 *MeV*

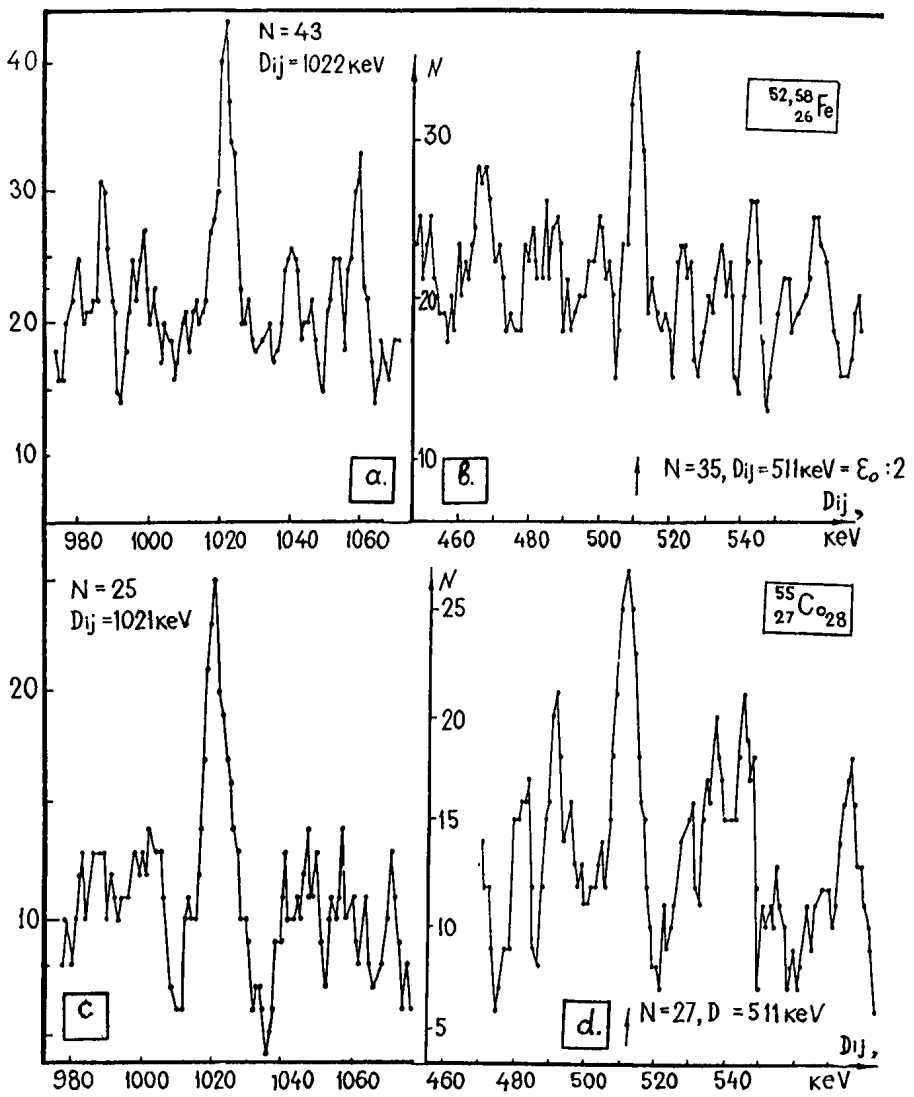

Fig.2. Distribution of spacings $D=E_i^x - E_j^x$ for number of near-magic nuclei (a — ^{32,34,35}S and ^{38}Ar, b — ^{52,58}Fe, c — ^{82,84,86,88,90,94}Sr, d — ^{55}Co (summed distribution for the levels with similar J^π—values)

binding energy of nucleons in deutron and the ratio of stable energy splitting (with $\Delta J=1$) in nuclei with few-nucleon configuration (parameter $D = 341\ keV = \varepsilon_0/3$ of "non-statistical effects" on different shells due to residual spin-dependent interactions) to the Δ-excitation of nucleon.

Distinguished character of electrodynamics parameters possibly concerns the manifestation of intervals which are rational and multiple to m_e and D_0 in near-magic nuclei at different shells and the observation of long-range correlation to ε_0 in binding energies of nuclei [3].

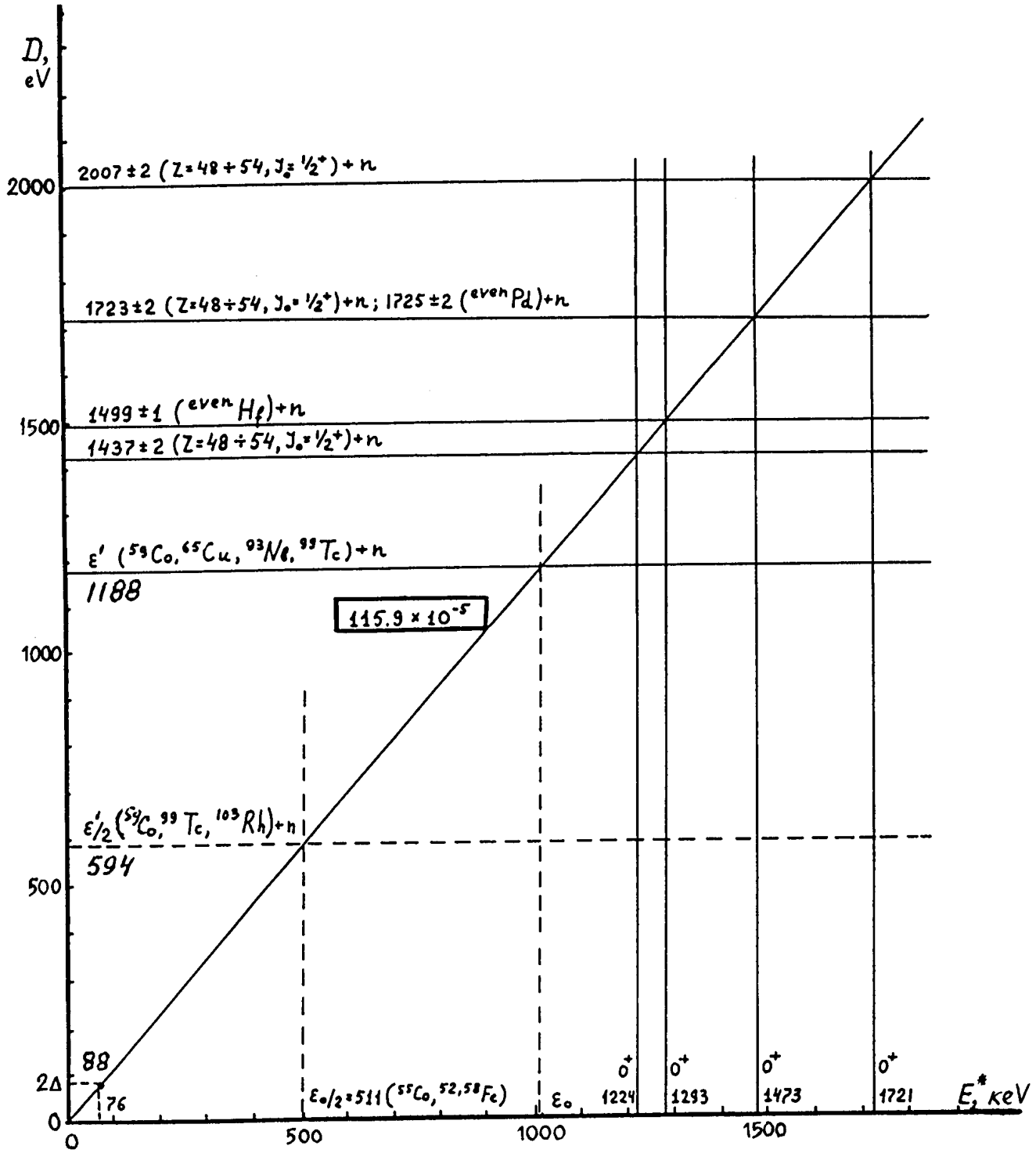

Fig.3. Ratio of distinguished intervals D in neutron levels (horisontal lines, values in *eV*) to the energies E^* of 0^+ -excitations in $^{108,110,112}Cd$ and ^{176}Hf (multiple to each other)

Table

Comparison of dimensionless ratios in parameters of non-statistical effects and in masses of particles with the polarization correction of electrodynamics $\alpha/2\pi$

N	Quantity	Components of ratios	Value $\times 10^5$
	$\alpha/2\pi$	$\Delta\mu_e/\mu_e = (\alpha/2\pi - 0.328\,\frac{\alpha^2}{\pi^2}) = 115.965 \times 10^{-5}$	116.141
1	$\varepsilon''/\varepsilon'$	$(1.35 \pm 0.02\,eV) : (1.16 \pm 0.01\,keV)$	116 ± 3
	$\varepsilon'/\varepsilon_0$	$(1.16 \pm 0.01\,keV) : (\varepsilon_0 = 1022\,keV)$	114 ± 1
		$\Sigma D/\Sigma E^{\chi}(0^+)$	115.9 ± 0.1
2	m_μ/M_z	$M_\mu/(M_z = 91161 \pm 31\,MeV)$	115.90 ± 0.04
3	m_e/M_q	$M_q = M(\Xi^-)/3 = 3/2\,(M_\Delta - M_N) = 3m_S$	116.02
	$D/(M_\Delta - M_N)$	$(341 \pm 2\,keV) : (1232 - 939 = 293\,MeV)$	116.4 ± 1.0
	$E_D/2M_N$	$2224\,keV/2M_N = E_D/1877.9\,MeV$	118.4
4	$D_0/M(\Lambda)$	$1293.318\,keV/M(\Lambda) = 1115.63 \pm 0.05\,MeV$	115.927
5	$\Delta m_\mu/m_\mu$	$[(23 \cdot 9m_e = 13 \cdot 16\,m_e - m_e) - m_\mu]/m_\mu = 118.4\,keV/m_\mu$	112.1
6	$\Delta m_n/m_\pi$	$(n \times 16m_e - m_e - m_n)/m_\pi = (161.7 \pm \pm 0.2\,keV)/m_\pi$	115.86
7	$\Delta(\Delta m_\pi)/\Delta m_\pi$	$(9m_e - 4593.66 \pm 0.48\,keV)/9m_e$	116 ± 10

References

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2. *Sukhoruchkin S.I. //Proc.40-th Conf.Nucl.Spectr., Leningrad. 1990. P.147.*
3. *Sukhoruchkin S.I. LNPI Research Report 1988-1989. Leningrad. 1990. P.78.*