Is the Field of Numbers a Real Physical Field? On the Frequent Distribution and Masses of the Elementary Particles

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Frequent distributions of the databases of the numerical values obtained by resolving algorithms, which describe physical and other processes, give a possibility for bonding the probability of that results the algorithms get. In the frequent distribution of the *fractions* of integers (rational numbers), local maxima which meet the ratios of masses of the elementary particles have been found.

Consider a general case of an arbitrary function $F(x, y, z, \ldots)$. Take under consideration a region of the values of this function, split into numerous intervals. Filling up the intervals by item-by-item examination of the possible numerical values of the parameters $x, y, z, \ldots$, expressed with integers, will be non-uniform.

Any algorithm has its own individual *frequent distribution*. The distributions can be created* for any formula, which has two or more free parameters (the distributions of the parameters can sometimes have unexpected or complicate form, containing both minima and peaks of the probability).

Frequent distributions give a possibility for bonding the probability of the appearance of numerical values of a function in the region of its existence. This is because the number of the numerical values of the function, hitting into a respective interval, in by item-by-item examination of the possible numerical values of the function's arguments, is proportional to the probability of an average numerical value of the function in the interval. The frequent distributions manifest the reproductivity of numerical values of the function due to the possible variations of its arguments. A frequent distribution itself cannot provide exact numerical solutions. However, if the object or process under consideration is described by not a single function but a few ones, the frequent distributions of these functions can logically be summarized or multiplied in order to manifest, more clear, such regions wherein the probability is high to that in the rest regions. Form of the distribution depends on both the form of the function and the dependencies among the positive integers; in the distribution obtained as above, the properties of the integers become not limited by the plain function of their item-by-item examination, but are more complicate thus an *individualization* of the integers occurs.

Once sharp manifested maxima, attractors, or regions of zero probability appear, it is important to find what peculiarities the algorithm bears. This however can be done only through respective analysis of a large number of the calculation results. In early years, this problem was unable to be considered in serious: processing so large numerical databases, and enforced extracting the probability from chaos, require huge time of routine job; therefore this job became accessed only due to the computer techniques.

It should be noted that the discrete nature of experimental results was discovered in the background of normal distribution of their numerical values (fine structure of the histograms) in already many years ago, by experimental studies conducted, commencing in 1951, by Simon E. Shnoll and his experimental team (see his monograph [1] and bibliography therein). As a result, Shnoll suggested that form of the histograms is connected with the mathematical algorithms, which express the respective processes we measure.

Below are specific examples, which illustrate the connexion of the frequent distributions and the real physical processes and phenomena.

There is a very interesting property of the frequent distributions: several kinds of the distributions include the *ratios of masses of the elementary particles*. This property is attributed to the frequent distributions of the databases of numerical values of the functions, constructed on *fractions*. We found these are plain exponential functions $A^{x/y}$, where A is presented by special numbers $\pi = 3.1416\ldots$, $e = 2.17183\ldots$, and the reverse fine structure constant $\alpha = 137.036\ldots$ In a few cases (hyperons), we mean A the relative mass of the proton $m_p/m_e = 1836$.

In order to be sure in it, we should do follows. Collect a database of numerical values of such a function in the framework of the complete item-by-item examination of its arguments x and y presented by integers, and in the scale which is enough large for covering the necessary scale of masses of the elementary particles (in the units of mass of the electron). Then we should distribute the numerical values along the axis of abscissas, covering numerous intervals by them. Once the distribution done, we will see that it has local maxima (peaks) in numerous locations of the scale, which meet the numerical values of masses of the elementary particles. Peaks of the distributions have a delta-like form.

Distributions of fractions along the numerical axis are self-similar. They reproduce themselves in the peaks of the first, the second and higher orders upto most small segments of the scale. It is possible to see that there is a fractal struc-

*There is a ready-to-use function "frequency" in MS Excel; another software can be applied as well.

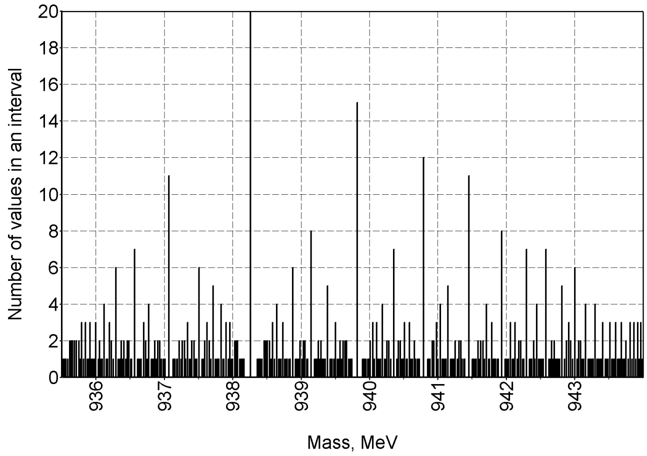

Fig. 1: Mass of the proton (938.27) in distribution $0.511\,\pi^{x/y}$.

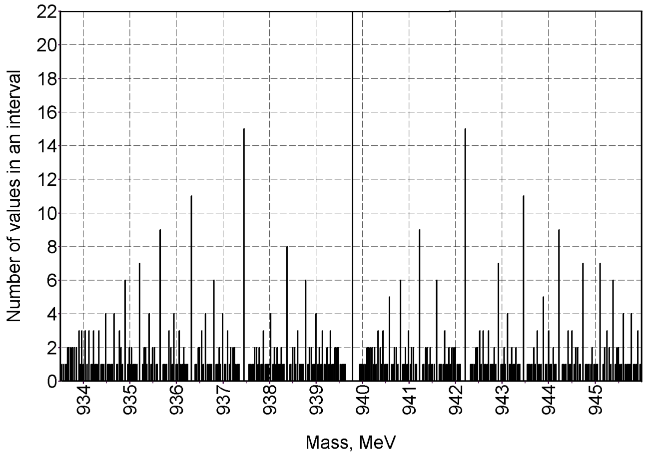

Fig. 2: Mass of the neutron (939.57) in distribution $0.511\,a^{x/y}$.

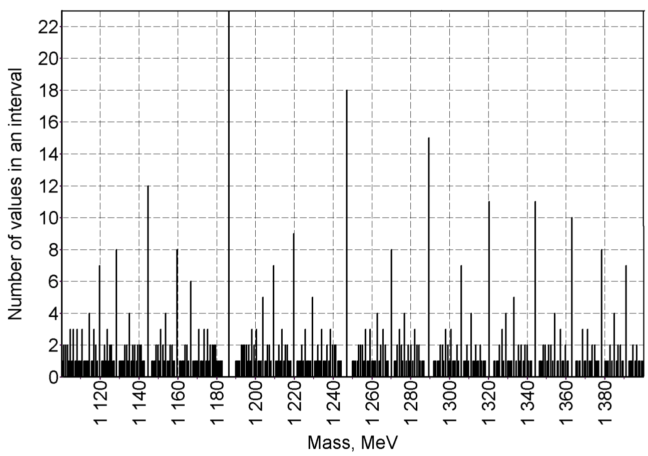

Fig. 3: Mass of the Σ^+ (1189) particle in distribution $0.511\,e^{x/y}$.

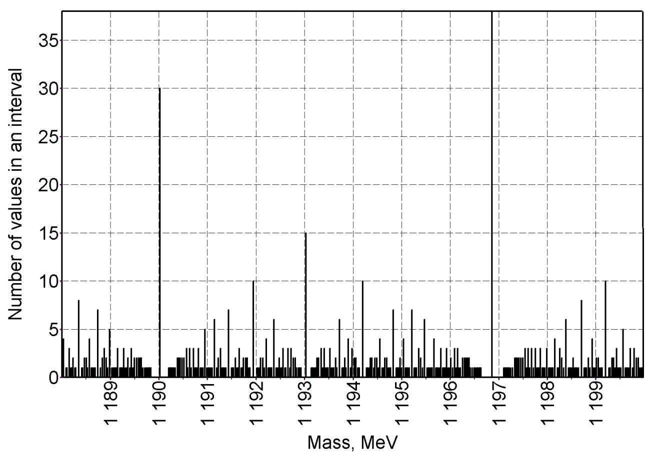

Fig. 4: Masses of the Σ^+ (1189.4), Σ^0 (1192.5), Σ^- (1197.3) particles in distribution $0.511\,a^{x/y}$.

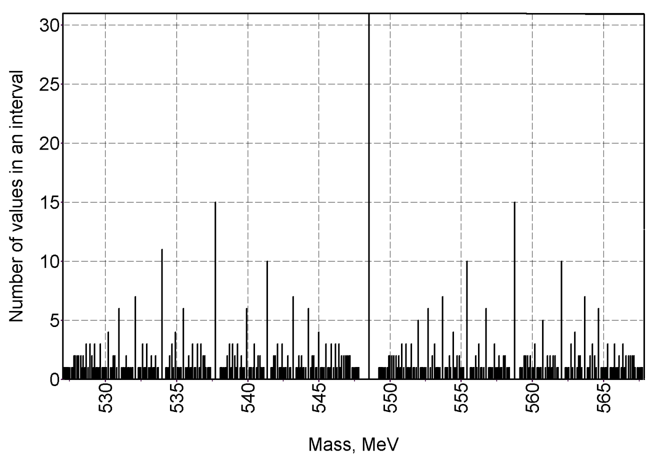

Fig. 5: Mass of the η (548.8) particle in $0.511\,(m_p/m_e)^{x/y}$ distribution.

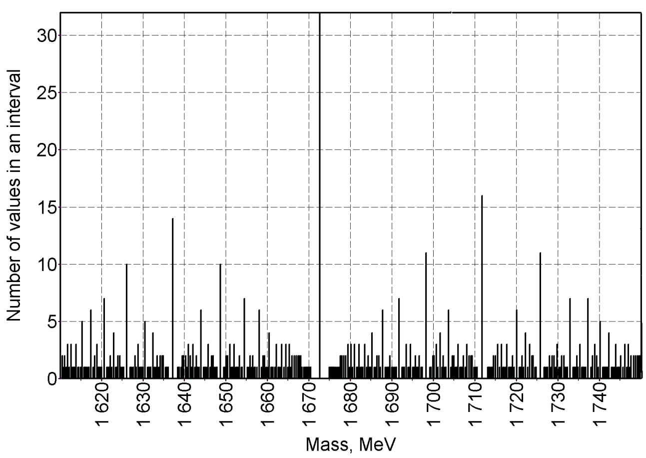

Fig. 6: Masses of the Ω^-, Σ_1 (1672, 1670) particles in distribution $0.511\,(m_p/m_e)^{x/y}$.

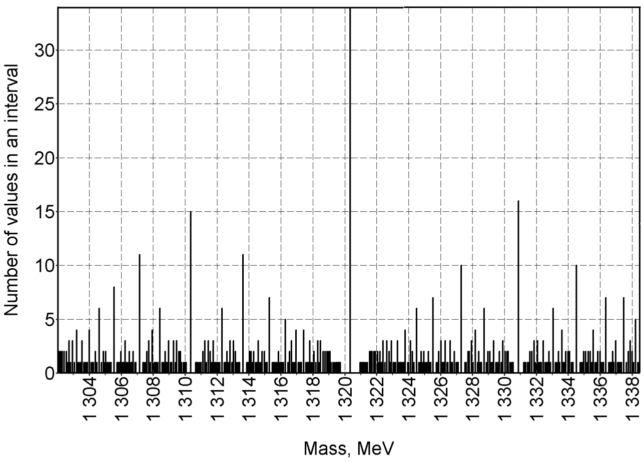

Fig. 7: Mass of the Ξ^-- (1321) particle in $0.511\,(m_p/m_e)^{x/y}$ distribution.

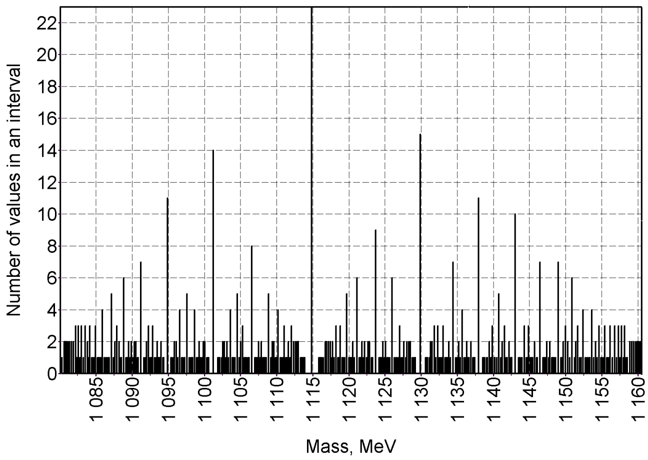

Fig. 8: Mass of the Λ (1115) particle in distribution $0.511\,a^{x/y}$.

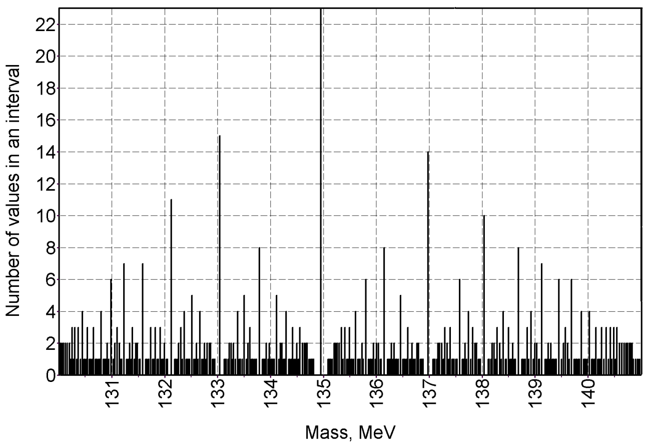

Fig. 9: Mass of the π^0 (134.9) particle in distribution $0.511\,a^{x/y}$.

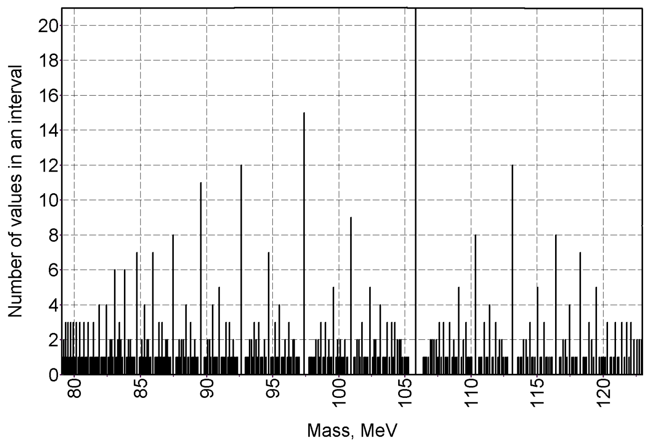

Fig. 10: Mass of the μ^- (105.7) particle in distribution $0.511\,e^{x/y}$.

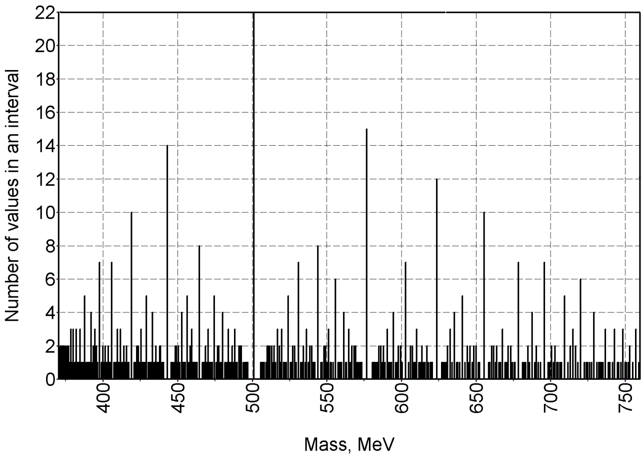

Fig. 11: Mass of the K^0 (498.7) particle in distribution $0.511\,a^{x/y}$.

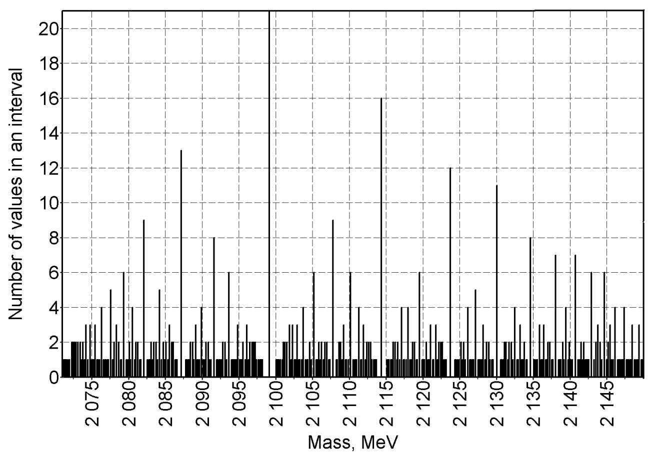

Fig. 12: Mass of the Λ_4 (2100) particle in $0.511\,(m_p/m_e)^{x/y}$ distribution.

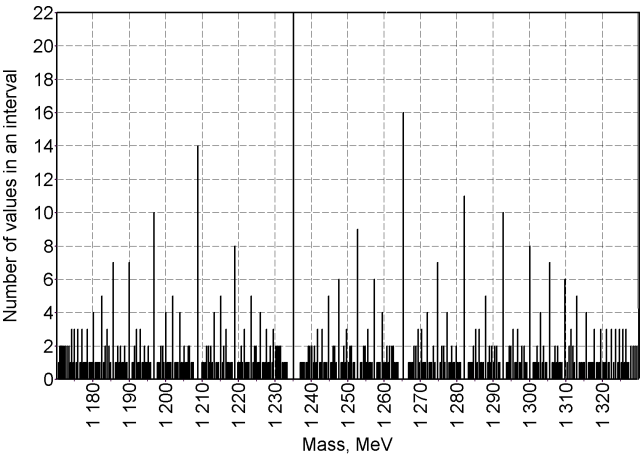

Fig. 13: Masses of the b_1^0, Δ_1 (1233, 1232) particles in distribution $0.511\,a^{x/y}$.

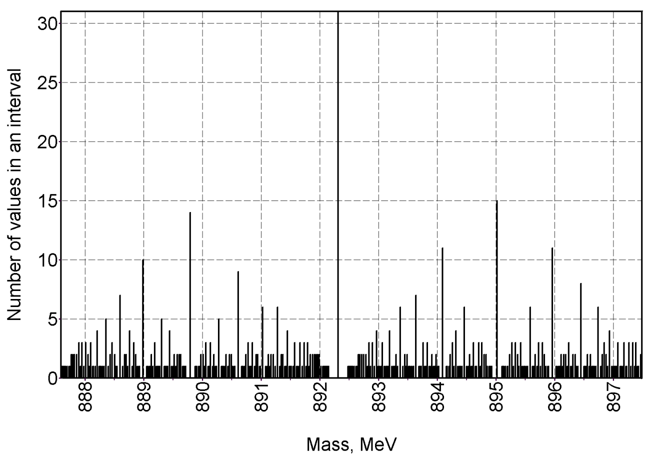

Fig. 14: Mass of the K^* (892.2) particle in distribution $0.511\,a^{x/y}$.

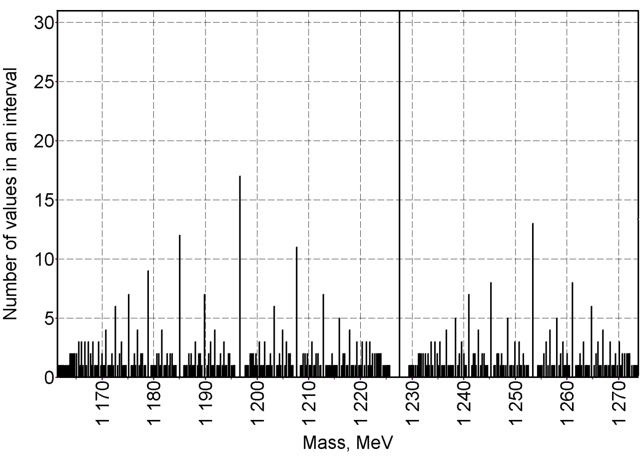

Fig. 15: Mass of the B (1230) particle in distribution $0.511\,\pi^{x/y}$.

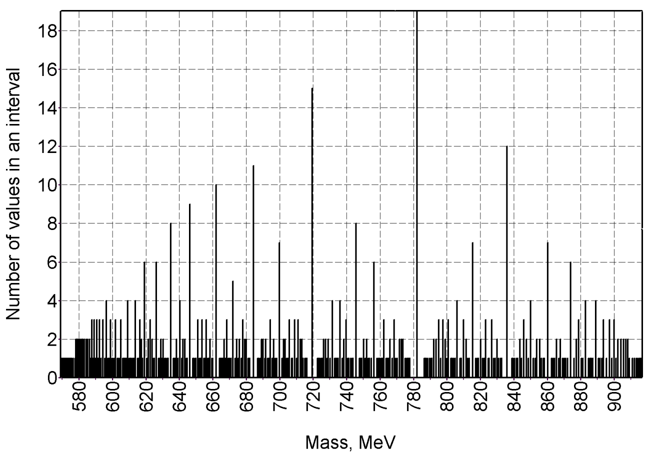

Fig. 16: Mass of the ω (782.7) particle in distribution $0.511\,e^{x/y}$.

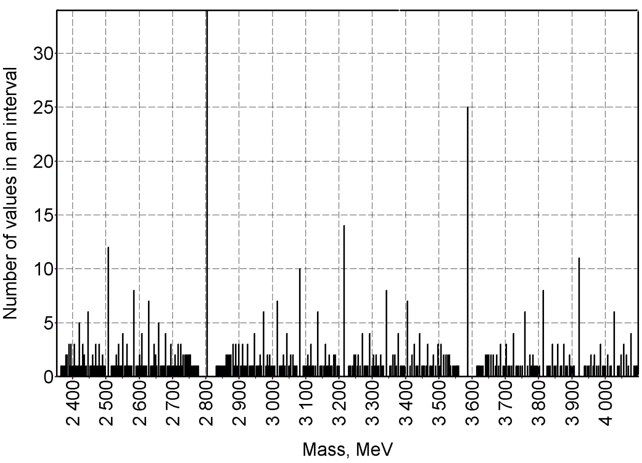

Fig. 17: Masses of the η_c (2820), χ (3556) particles in distribution $0.511\,a^{x/y}$.

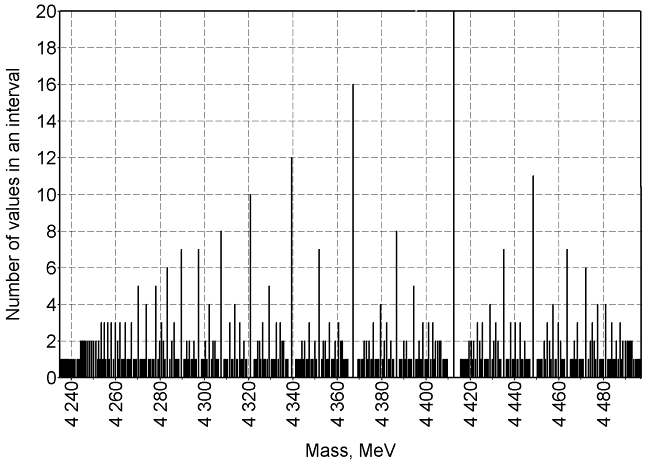

Fig. 18: Mass of the ψ''' (4414) particle in distribution $0.511\,a^{x/y}$.

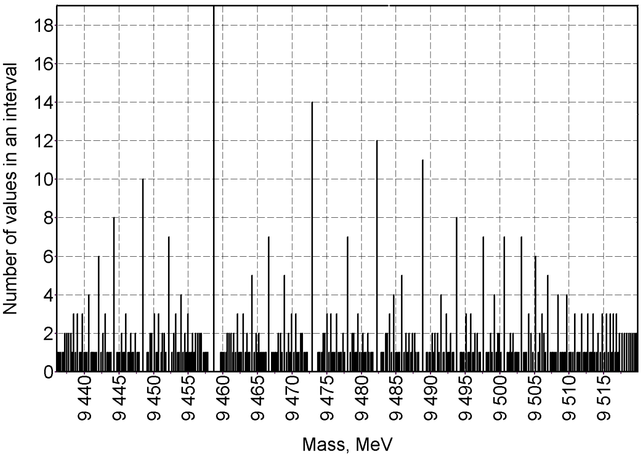

Fig. 19: Mass of the Y (9460) particle in distribution $0.511\, e^{x/y}$.

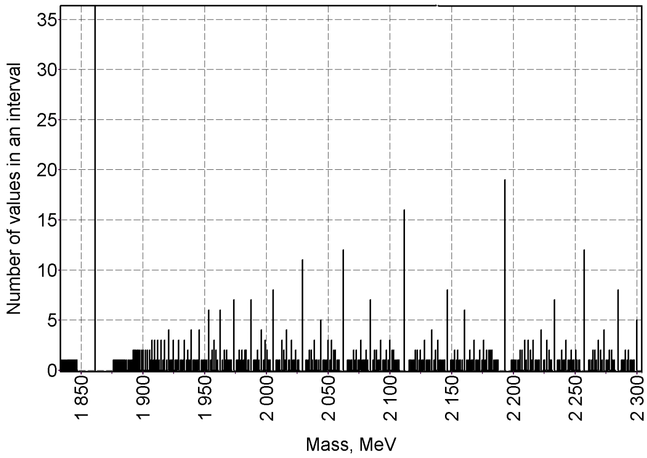

Fig. 20: Some main peaks correspond with masses of the D^0 (1863), D^{*0} (2006), Σ_3 (2030), N_4 (2190), Λ_c^+ (2260) particles in distribution $0.511\, a^{x/y}$.

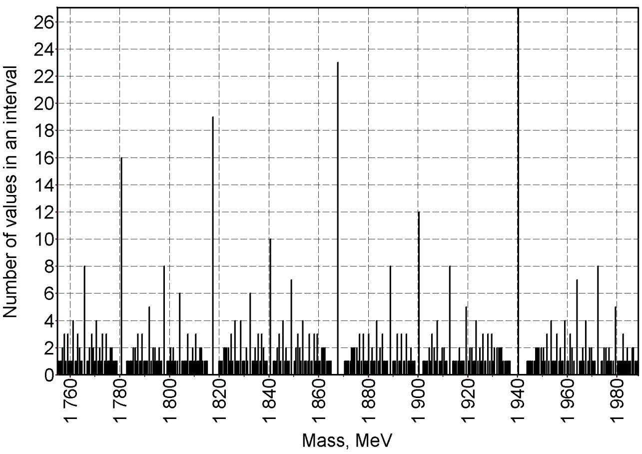

Fig. 21: Main peaks correspond with masses of the τ^- (1782), Λ_3, Ξ_1 (1820, 1820), D^+ (1868), S (1940) particles in distribution $0.511\, \pi^{x/y}$.

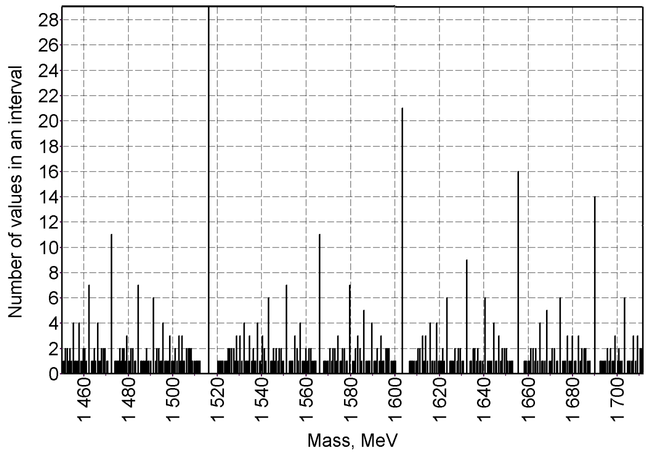

Fig. 22: Main peaks correspond with masses of the f′, Λ_2, N_2 (1516, 1518, 1520), ρ' (1600), Δ_2 (1650), N_3, g (1688, 1690) particles in distribution $0.511\, a^{x/y}$.

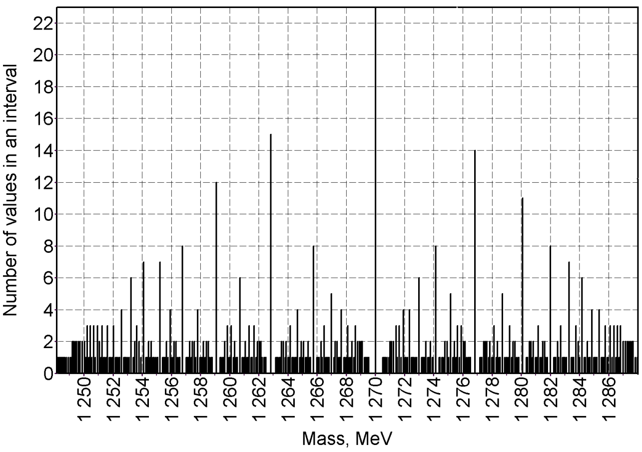

Fig. 23: Mass of the f (1270) particle in distribution $0.511\, e^{x/y}$.

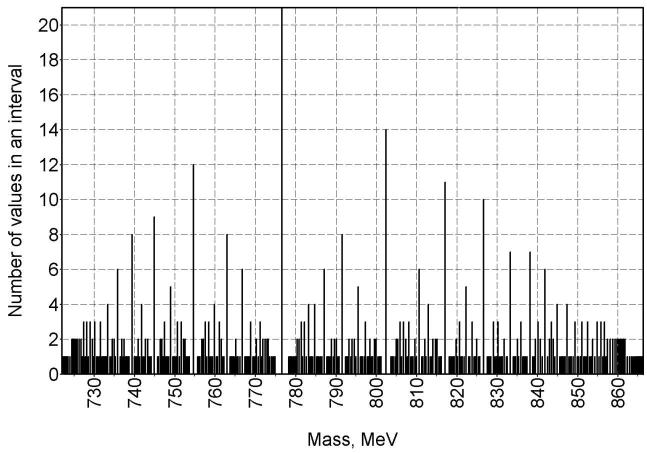

Fig. 24: Mass of the ρ (773) particle in distribution $0.511\, \pi^{x/y}$.

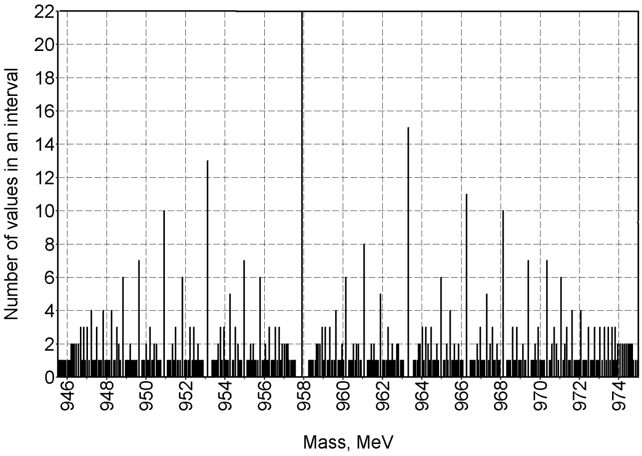

Fig. 25: Mass of the η' (958) particle in distribution $0.511\,\pi^{x/y}$.

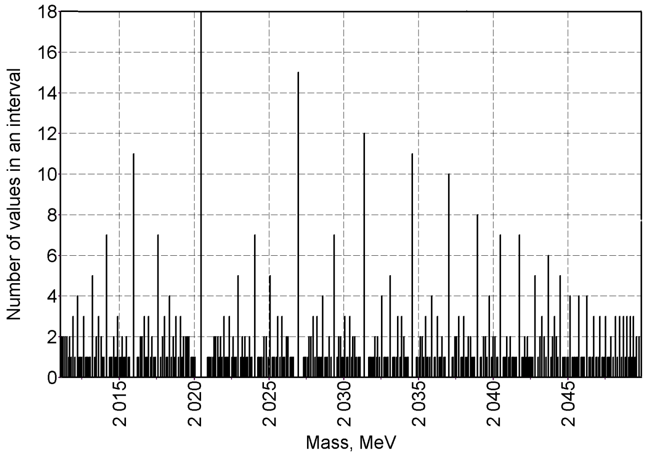

Fig. 26: Mass of the h (2020) particle in distribution $0.511\,\pi^{x/y}$.

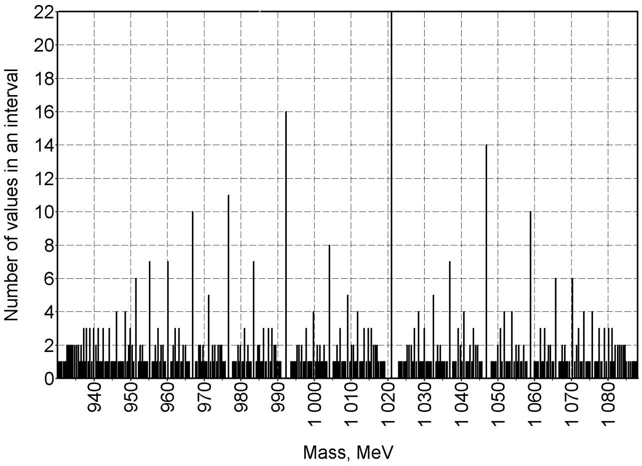

Fig. 27: Mass of the φ (1020) particle in distribution $0.511\,e^{x/y}$.

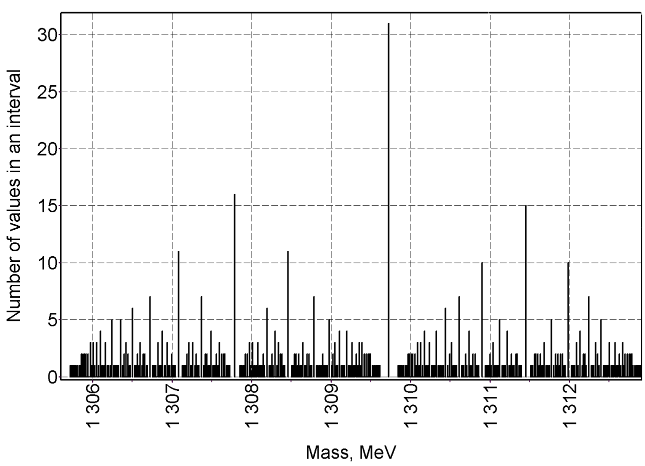

Fig. 28: Mass of the A (1310) particle in distribution $0.511\,a^{x/y}$.

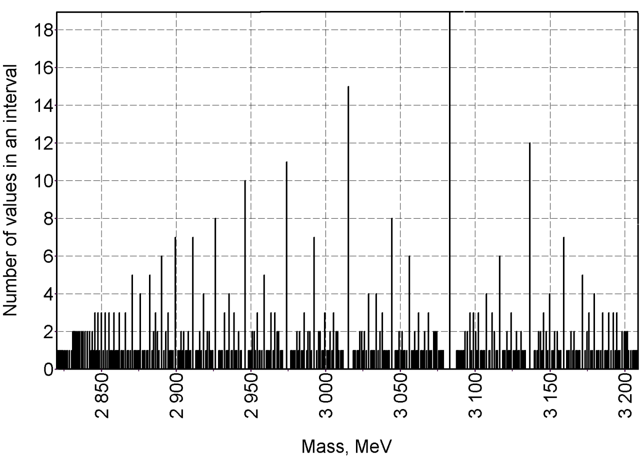

Fig. 29: Mass of the J/ψ (3096) particle in distribution $0.511\,a^{x/y}$.

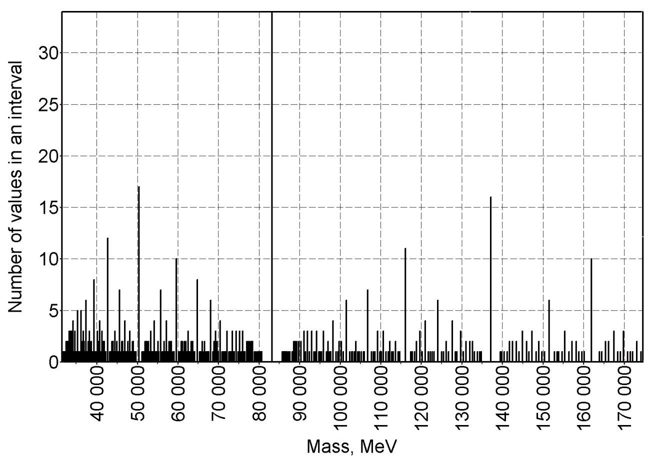

Fig. 30: Mass of the W (82000) particle in distribution $0.511\,e^{x/y}$.

ture of the distribution, when compressing the scale of the diagram by respective changing the variations by x and y (with the same number of the interval unchanged). Therefore, generally speaking, any arbitrary numerical value of the mass could meet, in the diagram, a peak of the first or higher orders. An objective criterion can be a relative error of the calculation, which is the ratio of the error of our calculation by the length of the respective local interval (or the distance between the peaks of the same order; the peak heights differ from each other as seen in Fig. 21 and Fig. 22). I checked about 50 numerical values of the masses; the relative error of the calculation was under a few percents only.

Figures 1–30 show specific examples of my calculations: these are frequent distributions, local maxima of which meet the relative masses of very different particles. The axis of abscissas is given in MeV. The histograms are created in the same way; they have 1000 numerical values distributed along 350 intervals.

It is probable, all the masses meet respective peaks in the distributions. This is not a result of my "passion" to numerology. This also does not mean that the masses of the particles are expressed just by the same functions. Meanwhile, these correspondences appear with so high precision and so often that they cannot be random, absolutely. On the other hand, the numerical values of some masses meet not the peaks, whose height is proportional to the number of the pairs x and y producing the same fraction, but empty spaces neighbouring the peaks (the spaces are presented by most rare appeared ratios of the prime numbers). As is obvious, the empty space neighbouring the peaks manifest minima of the relative density of rational numbers in their distribution along the numerical axis. Connexion of the spaces with the most stable states of oscillation processes was shown by Kyril I. Dombrowski [2, 3].

Is there a spectrum of masses of the elementary particles, if we mean it as the presence of the cross-dependency of the masses, and a possible algorithm of their calculation? I think that not. This is despite we can suppose that the numerical values of the masses constitute the "fine structure" of a distribution according to an unknown algorithm.

It is likely as the numerical values of the masses have a probabilistic origin, and are connected somehow with the properties of the prime numbers. It is probable, a rôle is played here by the fact that the prime number fractions or ratios are more fundamental quantities than the prime numbers themselves. This is because each single fraction of the infinite row is a result of ratios of infinite number of the pairs of arbitrary prime numbers.

At present time, many elementary particles were experimentally discovered. The particles have very different lifespans. This fact and also the shape of distributions constructed on fractions lead us to a conclusion that the first order masses "create" the second order masses, the second order masses "create" the third order masses, and so on to infinity. Such a

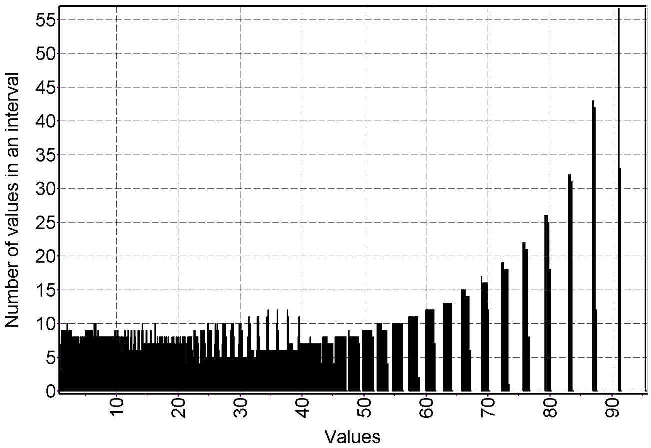

Fig. 31: Distribution on the function $100\exp\left(-ax\,(b-y)^{0.5}\right)$, where $a = 0.00147$, $b = 1000$.

process is specific to a continuous non-viscous medium, when perturbations appear in it. We cannot except that physical experiments can produce infinite variety of the elementary particles.

Another example is provided by frequent distribution of the exponent (Fig. 31)

$$100\ \exp\left(-ax\,(b-y)^{0.5}\right)\,,$$

modelling the well-known formula which expresses the transparency of the potential barrier of the tunnelling effect, where x and y are variables characterizing mass and energy of the particle. Shape of the distribution is very dependent on the numerical coefficients a and b. Moreover, several numerical values of the function are not realized at all. This form of histograms is specific to those functions, which do not contain ratios or fractions.

In this case, in item-by-item examination of the integers x and y along an abstract scale from 1 to 100, there is about 10,000 numerical values of the exponent. The axis of ordinates means the number of the coinciding numerical values of the function along the interval.

As we found, the distribution of the exponent has the most number of the intervals (nonzero numerical values of the ordinate, whose common number is as well dependent also on the given length of the unit interval) with several specific numerical values a and b. For instance, Fig. 31. With $b = 1000$ and $a = 0.00147$, difference between the neighboring intervals (i.e. the relative length of the interval) is 0.003 of the current numerical value f the function, while this is in the background of 1124 nonzero intervals (the graph has 10,000 intervals totally).

With these parameters, the term under the exponent approaches numerically to -1 independent from the "size" of the database. On the other hand, the *tunnelling effect* appears with the *same condition* in an analogous physical formula! I also attempted to employ frequent distributions in order to explain the most brighty lines of the radiation spectra for different kinds of radiation [4].

Thus I suggest that, aside for the known physical fields, the field of the positive integers exists as a physical field of the Nature. Pattern of this field has concentrations (peaks) and rarefractions of integers, which determine special numbers such as e, π, and, probable, the fundamental physical constants (the fine structure constant, the gravitational constant, and the others). Physical phenomena process in the inhomogeneous background of this field; any function using the field of integers (database of integers) produces surfs of probability in it (a relative analogy). We should not except that the stable orbits of the cosmic bodies originate from the probabilistic frequent distributions in the gravitational field (the field of the gravitational potential) of the attracting masses they orbit.

It is obvious that the discrete distributions of experimental data, and also their connexion with the aforementioned frequent distributions, are true for the microscales in the first row. There in the microscales, physical quantities exist in the boundary of their decay, thus the possibility of this solution is due to the discrete origin of physical phenomena, which is manifested in the microscales very much. On the other hand, our conclusion are most probable true for a general case as well: non-prime numbers can be represented as the ratios of primes, so the aforementioned frequent distributions are still true for even smallest intervals.

Are we lawful to claim that the parameters of physical or other processes, which are described as above, have not only the quantitative expression but also the probabilistic expression as just said before?

Should we, within the given dependencies which describe some processes or phenomena, find out a possibility for the prediction of the regions of the most probable solutions as those most rational to the others, or for the prediction of those intervals of numerical values, where the considered phenomenon processes most intense (all these not only in the microscales)?

If so, we get a possibility for solving the reverse problems, which target re-construction of the probabilistic distribution of the primary experimental results on the basis of a respective algorithm. This is related first of all to those problems, which are based on the discrete data (primes). This is, for instance, industry or economics: the number of working sections, workgroups, units of equipment, produced units, the number of working personell, and so on.

If all that has been said above is true, and the results of solving similar algorithms (in the case where the algorithms are expressed by the functions whose arguments are more than two) can bear not only a numerical meaning but also a probabilistic meaning, this fact leads to important sequels. There are many problems where numerous parameters are unknown, or cannot be determined in exact. This is economics, game theory, military, meteorology, and many others. In such a case, given a respective algorithm, we could replace the unknown parameters in it with the numbers taken in the respective interval then create frequent distributions thus obtaining probabilistic solutions. Experimental tests are needed in this direction.

Finally, I would like to attract attention of physicists to this problem surveyed here. As is probable, this problem draws that dialectic boundary where chaos meets order, and chance meets regularity.

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