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Abstract

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SOME RELATIONS

BETWEEN PHYSICAL CONSTANTS

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Let us consider a certain total and, consequently, unique specimen A. The establishment of the identity of the specimen with itself $A \equiv A$; $A \cdot \frac{1}{A} = 1$, may be regarded as a mapping that brings the images A into correspondence with the prototype A. The specimen A, by definition, can be compared only with itself; therefore the mapping is internal and, according to Stoilow' s theorem, can be represented as a superposition of a topological and a subsequent analytic mapping. The totality of the images A constitutes a point system whose elements are equivalent points; an n-dimensional affine extension containing $(n+1)$ elements of the system is transformed into itself linearly

$$x_i' = \sum_{k=1}^{n+1} a_{ik} x_k.$$

For all real a_{ik} the unitary transformation

$$\delta_{il} = \sum_k a_{ik}^* a_{lk} = \sum_k a_{ki}^* a_{kl} \quad (i, k = 1, 2, \dots, n+1)$$

is orthogonal, since $\det a_{ik} = \pm 1$; consequently, the transformation is a rotation or an inversional rotation.

The projective space containing the totality of all images of the object A is metrizable. The metric extension R^n, coinciding entirely with the whole projective extension, is, according to Hamel' s theorem, closed.

The group of coincidences of equivalent points representing the elements of the set of images A constitutes a finite system, which may be regarded as a topological extension mapped into the spherical space R^n. The surface of an $(n+1)$-dimensional sphere, equivalent to the volume of an n-dimensional torus, is completely, regularly, and everywhere densely filled by an n-dimensional, perfect, closed, and finite point system of images A. The dimension of the extension R^n, which wholly and only contains the set of elements of the mapping, may be any integer n in the interval from $(1 - N)$ to $(N - 1)$, where N is the number of specimens of the ensemble.

We shall consider sequences of random transitions between configurations of different numbers of dimensions as vector random quantities, i.e., as fields. Let the differential distribution function of the frequencies (tones) of transitions ν be given by the expression $\varphi(\nu) = \nu^n \exp[-\pi\nu^2]$. If $n \gg 1$, then the mathematical expectation of the transition frequency from the state n is equal to

$$m(\nu) = \int_0^\infty \nu^n \exp[-\pi\nu^2]\, d\nu \Big/ \int_0^\infty \exp[-\pi\nu^2]\, d\nu = \Gamma\left(\frac{n+1}{2}\right) \Big/ 2\pi^{(n+1)/2}.$$

The statistical weight of the duration of a definite state is a quantity inverse to the probability of a change of this state. Therefore the most probable, actual, number of changes of the configuration of the ensemble is the number n for which the quantity $m(v)$ has a minimum. The reciprocal value of the function $m(v)$, $\Phi_n = 1/m(v) = sS_{n+1} = \tau V_n$, is isomorphic to the function of the magnitude of the surface of hyperspheres of unit radius in $(n+1)$-dimensional space. This isomorphism is adequate to the ergodic conception, according to which the spatial and temporal totalities are equivalent aspects of a manifold. The positive branch of the function Φ_n is unimodal; for negative values of $(n+1)$ the function is sign-changing.

The maximum value of the volume of the extension of a formation occurs at $n = \pm 6$; consequently, the most probable and the least probable, extremal, distribution of the elementary images of the object A corresponds to a 6-dimensional configuration.

One of the basic concepts in the theory of dimension of combinatorial topology is the concept of a nerve, from which it follows that every compact metric extension of dimension $2n + 1$ can be homeomorphically mapped onto a Euclidean subset of dimension n.

All even-dimensional spaces may be regarded as products of two odd-dimensional extensions of the same dimension and opposite orientation, embedded in one another. All odd-dimensional projective spaces, when immersed in the extension of their own dimensions, are orientable, whereas spaces of even dimension are one-sided. Thus the extension, the form of existence of the object A, is a $(3 + 3)$-dimensional complex manifold consisting of the product of a 3-dimensional space-like extension and an orthogonal 3-dimensional time-like extension, possessing orientation. The geometry of these manifolds is determined by the metric established in them, which measures the interval with the quadratic form

$$\Delta s^2 = \Phi_n^2 \sum_{ik}^{n} g_{ik} \Delta x^i \Delta x^k \quad (i, k = 1, 2, \dots, n),$$

which depends, in addition to the coordinate functions g_{ik}, also on the function of the number of independent parameters Φ_n.

The total extension of a manifold is finite and invariable; consequently, the sum of the extensions of the formations realized in it is a quantity invariant with respect to orthogonal transformations. The invariance of the total extension of a formation is expressed by the quadratic form $N_i r_i^2 = N_k r_k^2$, where N is the number of copies and r is the radial equivalent of the formation.

Configurations of negative dimension are inversion images corresponding to the antistates of the system; they possess mirror symmetry for $n = 2(2m-1)$ and direct symmetry for $n = 2(2m)$, $m = 1, 2, \ldots$. Configurations of odd dimension have no antistates. The volume of the antistates is equal to $V_{(-n)} = 4(-1/V_n)$.

The equations of physics assume a simple form if, as the system of measurement, one adopts the kinematic system (LT), whose units are two aspects of the inversion radius of the regions of the space R^n: l, an element of the space-like extension of the subspace L, and t, an element of the time-like extension of the subspace T. The introduction of homogeneous coordinates makes it possible to reduce the theorems of projective geometry to algebraic equivalents and the geometric relations to kinematic relations.

In the kinematic system the exponents in the structural formulas of the dimensions of all physical quantities, including electromagnetic ones, are integers.

Physical constants are expressed by certain relations of the geometry of an ensemble reduced to kinematic structures. The most stable form of the kinematic state corresponds to the most probable form of statistical coexistence of the formation. The value of physical constants can be determined as follows.

The maximum value of the probability of a state corresponds to the volume of a 6-dimensional torus and is equal to

$$V_6 = \frac{16\pi^3}{15} r^6 = 33.0733588 r^6.$$

The extremal values—the maximum of the positive and the least minimum of the negative branch of the function Φ_n—are equal to:

$$\begin{array}{ccc} n+1 & +7.256\,946\,404 & -4.991\,284\,10 \\ S_{n+1} & +33.161\,194\,485 & -0.120\,954\,210\,8. \end{array}$$

The ratio of the extremal values of the functions S_{n+1} is equal to

$$\bar{E} = |+S_{n+1\,\max}| \,/\, |-S_{n+1\,\min}| = 274.163208\, r^{12}.$$

On the other hand, a finite spherical layer of extent R^n, uniformly and everywhere densely filled by doublets of elementary formations A, is equivalent to a vortex torus concentric with it. The mirror image of this layer is another concentric homogeneous double layer, which, in turn, is equivalent to a vortex ring coaxial with the first. For the $(3+1)$-dimensional case, such formations were investigated by Lewis and Larmor.

The conditions of stationarity of vortex motion are satisfied when

$$V \times \operatorname{rot} V = \operatorname{grad} \varphi, \qquad 2\omega\, ds = d\psi = d\chi,$$

where the circulation χ is the basic kinematic invariant of the field. Vortex motion is stable in the case when the lines of flow coincide with the trajectory of the nucleus. For a $(3+1)$-dimensional vortex torus,

$$V_x = \frac{\chi}{2\pi D}\left[\ln\frac{4D}{r} - \frac{1}{4}\right],$$

where r is the radius of circulation and D is the diameter of the torus ring. The velocity at the center of the formation is $V_\odot = u\pi D/2r$.

The condition $V_x = V_\odot$ in our case is fulfilled when, for $n = 7$,

$$\ln\frac{4D}{r} = (2\pi + 0.250\,148\,03)\frac{2n+1}{2n} = 2\pi + 0.250\,148\,03 + \frac{n}{2n+1} = 7,$$

$$D/r = \bar{E} = {}^1\!/_4 e^7 = 274.15836.$$

In the field of a vortex torus at the Bohr radius of the charge, $\gamma = 0.999\,902\,8$ and π assumes the value $\pi^* = 0.999\,951\,4\,\pi$. Then

$$E = {}^1\!/_4 e^{6.999\,696\,8} = 274.074\,996.$$

Introducing the ratio $B = V_6 E/\pi = 2885.3453$, in the kinematic system $[LT]$ we shall uniformly express the quantities of all physical constants K by simple relations between E and B:

$$K = \delta E^\alpha B^\beta,$$

where δ is equal to some quantized rotation, and α and β are certain integers.

Table 1 gives the analytical and experimental values of some physical constants, and the appendix gives an experimental determination of the units of the CGS system, since they are conventional quantities and not physical constants.

Table 1

	$K = \delta E^{\alpha} B^{\beta}$	Analytical values	Experimental values
Sommerfeld constant	$2^{-1}\pi^{0}EB^{0}$	$1,370\ 374\ 9 \cdot 10^{2} l^{0} t^{0} \mathrm{cm}^{0} \cdot \mathrm{g}^{0} \cdot \mathrm{sec}^{0}$	$1,370\ 374\ 3 \cdot 10^{2}$
Gravitational constant	$2^{-2}\pi^{-1}E^{0}B^{0}F$ *	$7,986\ 888\ 8 \cdot 10^{-2} l^{0} t^{0} 6,670\ 024\ 6 \cdot 10^{-8} \mathrm{cm}^{3} \cdot \mathrm{g}^{-1} \mathrm{sec}^{-2}$	$6,670 \cdot 10^{-8}$
Basic charge ratio	$2^{0}\pi^{0}E^{0}B^{6}$	$5,770\ 146\ 0 \cdot 10^{21} t^{0} 5,273\ 304\ 76 \cdot 10^{17} \mathrm{cm}^{3/2} \cdot \mathrm{g}^{-2} \cdot \mathrm{sec}^{1/2}$	$5,273\ 058\ 5 \cdot 10^{17}$
Basic mass ratio	$2^{1}\pi^{-1}E^{0}B^{1}$	$1,836\ 867\ 8 \cdot 10^{3} l^{0} t^{0} \mathrm{cm}^{0} \cdot \mathrm{g}^{0} \cdot \mathrm{sec}^{0}$	$1,836\ 30 \cdot 10^{3}$ **
Effective gravitational radius of the electron	$2^{-1}\pi^{0}E^{0}B^{-12}$	$2,390\ 102\ 2 \cdot 10^{-43} l t^{0} 0,673\ 49\ 1 \cdot 10^{-55} \mathrm{cm}^{1} \cdot \mathrm{g}^{0} \cdot \mathrm{sec}^{0}$	$0,674 \cdot 10^{-55}$
Electric radius of the electron	$2^{-1}\pi^{-1}E^{0}B^{-6}$	$2,758\ 247\ 7 \cdot 10^{-21} l^{0} 7,772\ 329\ 1 \cdot 10^{-35} \mathrm{cm}^{1} \cdot \mathrm{g}^{0} \cdot \mathrm{sec}^{0}$	–
Classical radius of the electron	$2^{2}\pi^{0}E^{0}B^{0}$	$1,000\ 000\ 0 \cdot 10^{0} l t^{0} 2,817\ 850\ 2 \cdot 10^{-13} \mathrm{cm}^{1} \cdot \mathrm{g}^{0} \cdot \mathrm{sec}^{0}$	$2,817\ 85 \cdot 10^{-13}$
Cosmic radius	$2^{1}\pi^{1}E^{0}B^{12}$	$2,091\ 961\ 2 \cdot 10^{42} l^{3} t^{-2} 5,894\ 831\ 5 \cdot 10^{29} \mathrm{cm}^{1} \cdot \mathrm{g}^{0} \cdot \mathrm{sec}^{0}$	$6, 10^{29} > 10^{28}$
Electron mass	$2^{0}\pi^{0}E^{0}B^{-12}$	$3,003\ 491\ 6 \cdot 10^{-43} l^{3} t^{-2} 9,108\ 300\ 6 \cdot 10^{-28} \mathrm{cm}^{0} \cdot \mathrm{g}^{1} \cdot \mathrm{sec}^{0}$	$9,1083 \cdot 10^{-28}$
Nucleon mass	$2\pi^{-1}E^{0}B^{-11}$	$5,517\ 016\ 4 \cdot 10^{-39} l^{3} t^{-2} 1,673\ 074\ 2 \cdot 10^{-24} \mathrm{cm}^{0} \cdot \mathrm{g}^{1} \cdot \mathrm{sec}^{0}$	$1,6725 \cdot 10^{-24}$ **
Cosmic mass	$2^{2}\pi^{2}E^{0}B^{12}$	$1,314\ 417\ 5 \cdot 10^{43} l^{3} t^{-2} 3,936\ 064\ 2 \cdot 10^{57} \mathrm{cm}^{0} \cdot \mathrm{g}^{1} \cdot \mathrm{sec}^{0}$	$> 10^{56}$
Cosmic period	$2^{1}\pi^{1}E^{0}B^{12}$	$2,091\ 931\ 2 \cdot 10^{42} l^{0} t^{1} 1,956\ 300\ 9 \cdot 10^{19} \mathrm{cm}^{0} \cdot \mathrm{g}^{0} \cdot \mathrm{sec}^{1}$	$2 \cdot 10^{19} > 10^{7}$
Electron charge	$2^{0}\pi^{0}E^{0}B^{-6}$	$1,733\ 058\ 4 \cdot 10^{-21} l^{3} t^{-2} 4,802\ 850\ 2 \cdot 10^{-10} \mathrm{cm}^{3/2} \cdot \mathrm{g}^{-1} \cdot \mathrm{sec}^{1/2}$	$4,802\ 86 \cdot 10^{-10}$
Number of elementary specimens	$2^{2}\pi^{2}E^{0}B^{24}$	$4,376\ 299\ 0 \cdot 10^{84} l^{0} t^{0} \mathrm{cm}^{0} \cdot \mathrm{g}^{0} \cdot \mathrm{sec}^{0}$	$> 10^{82}$

* $F = E/(E-1) = 1,003\ 662\ldots$

** The mass of the proton is equal to $0,999\ 695$ of the nucleon mass.

The agreement between the theoretical and observed values of the constants makes it possible to suppose that all metric properties of the total and unique specimen under consideration can be identified with the properties of the observed World, identical with the sole fundamental "particle" A. In another communication it will be shown that the $(3+3)$-dimensionality of space–time is an experimentally verifiable factor and that the 6-dimensional model is free of the logical difficulties created by the $(3+1)$-dimensional conception of the background.

Appendix

Determination of the magnitude of 1 cm CGS. The analytical value of the Rydberg constant $[R_\infty] = (1/4\pi E^3)l^{-1} = 3,092\ 2328 \cdot 10^{-8} l^{-1}$, the experimental value of the Rydberg constant $(R_\infty) = 109\ 737,311 \pm 0,012$ cm^{-1}; consequently, 1 cm CGS $= (R_\infty)/[R_\infty] = 3,548\ 8041 \cdot 10^{12} l$.

Determination of the magnitude of 1 sec CGS. The analytical value of the fundamental velocity $[c] = l/t = 1$; the experimental value of the speed of light in vacuum $(c) = 2,997\ 930 \pm 0,000\ 080 \cdot 10^{10}$ cm sec^{-1}; consequently, 1 sec CGS $= (c)/l[c] = 1,063\ 906\ 6 \cdot 10^{23} t$.

Determination of the magnitude of 1 g CGS. The analytical value of the ratio $[e/mc] = B^6 l^{-1} t = 5,770\ 146\ 0 \cdot 10^{20} l^{-1} t$; the experimental value of the ratio $(e/mc) = 1,758\ 897 \pm 0,000\ 032 \cdot 10^7\ (\text{cm} \cdot \text{g}^{-1})^{1/2}$; consequently,

$$1 \text{ g CGS} = \frac{(e/mc)^2}{l[e/mc]^2} = 3,297\ 532\ 5 \cdot 10^{-15} l^3 t^{-2}.$$

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Note: Figure translations are in progress. See original paper for figures.