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Masses of Nuclei Constituted from a Geometric Theory of Fields

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Abstract

It is possible to deduce quantities of particles and masses of nuclei from a geometry of gravitation and electromagnetism as found for the first time by Rainich. The theory is nothing else than General Relativity completed with a "simple idea" as foreseen by Wheeler. At this place, masses of nuclei are depicted by means of numerical simulations according to geometric equations. The algorithm is linked with chaos, so that the known singularity rule is revealed to be irrelevant.

Keywords: Theory of relativity, Numerical simulations, Einstein-Maxwell theory, Rainich theory, Quantization

1 Introduction: How to guarantee energy conservation

The theory is based on the tensor equations [4]

$$R_{ik} = \kappa \, (\frac{1}{4} \, g_{ik} F_{ab} F^{ab} - F_{ia} F_k{}^a) \quad , \tag{1}$$

$$F_{ij,k} + F_{jk,i} + F_{ki,j} = 0 \quad , \tag{2}$$

$$F^{ia}{}_{;a} = 0 \quad , \tag{3}$$

in which g_{ik} are the components of metrics, R_{ik} those of the Ricci tensor and F_{ik} those of the electromagnetic field tensor. κ is Einstein's gravitation constant. These equations are known as Einstein-Maxwell equations [1]. As well, here are used the *homogeneous* Maxwell equations, for force equilibrium and conservation of energy and momentum. The sources of related inhomogeneous equations are replaced by integration constants [3, 6]. Mass, spin, electrical charge, and magnetical momentum are the first integration constants.

The geometry resulting from the Einstein-Maxwell equations was already found by Rainich [2], and derived by a different method in [4].

2 On numerical simulations

Analytic solutions (different from zero) based on integration constants lead commonly to singularities. This is seen like an obstacle, as a rule. However, numerical simulations according to the Einstein-Maxwell equations, which are explained in detail in [5], result in another picture [3]:

Numerical simulations using iterative, non-integrating methods lead always to a boundary at the conjectural particle radius. As well, the actual singularity appears always within a geometric limit. The area within this geometric limit *according to observer's coordinates* is not locally imaged. The geometric limit is the mathematical reason for the existence of discrete solutions. It has to do with marginal problems, and additionally with chaos, see [3].

Here, it must be remarked that there is a limit to quantum models. A geometric theory of fields (General Relativity including classical electrodynamics without sources, see Sec. 1) takes particles, nuclei, atoms, &c. as discrete solutions of the Einstein-Maxwell equations. So, only particles can be simulated, which can exist out of a nucleus respectively atom. The simulation is impossible with quarks and bosons with strong and weak interaction as well as the Higgs boson.

In order to support or disprove the theory, one has to do lots of tests, because the particle quantities are integration constants and have to be inserted into the initial conditions (more see [3, 5]), which are set in the electrovacuum around the particle. Values of integration constants are the input of the simulations. The output is the number of iterations, which is a measure for the stability of the solution. The conversion of physical into normalized values and vice versa is described in detail in [3, 5]. Table 1 shows some values with a radius unit of 10^{-15}m. These examples grant convenient conversion.

	physical value	norm. value
proton mass	1.672×10^{-24}g	2.48×10^{-39}
$\hbar$	$1.054 \times 10^{-27}\mathrm{cm}^2\mathrm{g/s}$	5.20×10^{-40}
elem. charge	1.602×10^{-19}As	1.95×10^{-21}
μ_B	1.165×10^{-27}Vs cm	3.70×10^{-19}

Table 1: Physical and normalized values for conversion

The computation is done for all components along the inclination at a radius, and along the radius (with all inclination values) from outside to inside step by step until geometric limits are reached. The step count (iterations) until the first geometric limit of a metrical component (where the absolute value of the *physical* component becomes 1) depends on the inserted values of the integration constants. A relatively coarse grid reflects in strong dependences, however, the relevant values of the integration constants are imprecise. Computations with finer grid lead to smaller contrast of the step counts, but the values are more precise. As well, we get correct relevant values of the integration constants, when the geometric limit appears at the conjectural particle radius.

Fig. 1 shows tests around the free electron with spin, charge, and magnetic momentum as parameters. As well, the step count above a "threshold" is depicted with a more or less fat "point". The magnetic momentum of the electron arises specially sharply, for the dominant influence.

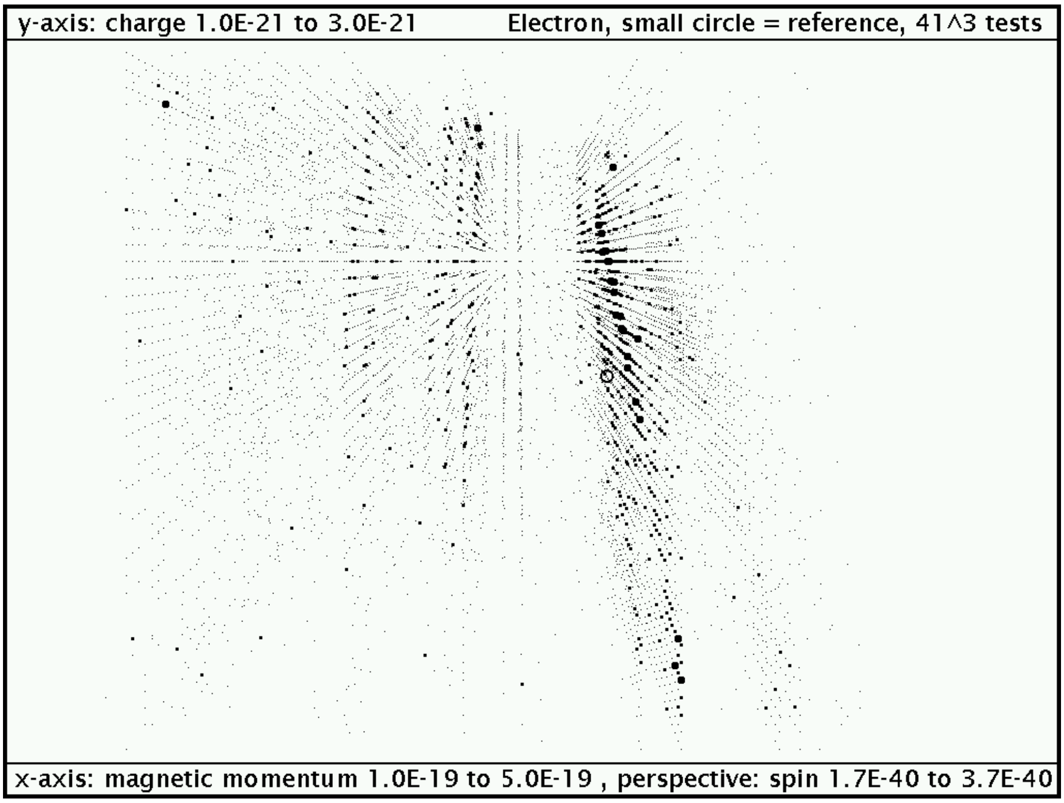

Figure 1: Tests around the electron. Parameters: Spin, charge, magn. momentum

3 How masses emerge

Similar results are to reach with the Helium nucleus, Fig. 2, and the Oxygen nucleus, Fig. 3, with mass and charge as parameters. (Spin and magnetic momentum are here zero.) The fact, that one can see the masses of proton and deuteron in Fig. 2, led to following idea:
The influence of mass to metrics prevails in a certain distance from the conjectural particle resp. nucleus radius. It could be possible to set the remaining parameters to zero. Fig. 4 and 5 show related tests, with possible assignment of tops in the figures to nuclei.

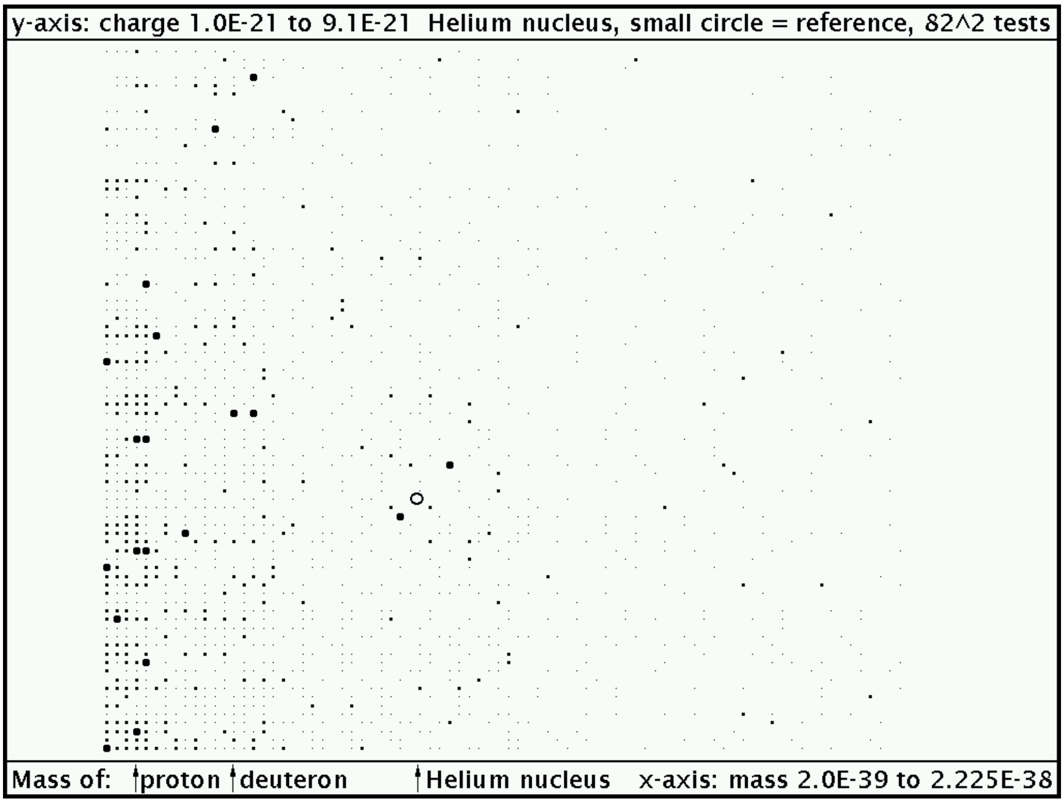

Figure 2: Tests around the Helium nucleus. Parameters: Mass and charge

It was necessary in the tests according to Fig. 3,4,5 to "pile up" the data. For it, several test series with *slightly* different parameters (mostly initial radius) have been done, and the related step counts (the output) have been added. So the "noise" from rounding errors is successively suppressed. With 80 bit floating point registers, the rounding error is in the 20th decimal. As well, the relative deviation of difference quotients from related differential quotients *in the first step* is roughly 10^{-20} – that is the limit, where one can see at all the influence of chaos.

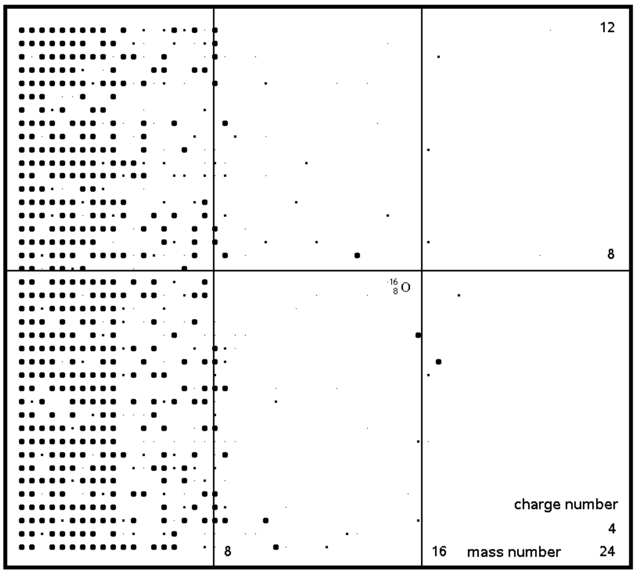

Figure 3: Tests around the Oxygen nucleus
Parameters: Mass and charge, initial radius 3.5, 6 times piled

Tests with higher precision are suggested. These open the possibility to find neutrino masses, provided that neutrinos have rest mass at all.

References

[1] A. Einstein, *Grundzüge der Relativitätstheorie.* A back-translation from the Four Lectures on Theory of Relativity, Akademie-Verlag Berlin, Pergamon Press Oxford, Friedrich Vieweg & Sohn Braunschweig, 1969.

[2] G. Y. Rainich, Electrodynamics in the General Relativity Theory, *Proc. N.A.S.*, **10** (1924), 124 and 294.

[3] U. E. Bruchholz, Key Notes on a Geometric Theory of Fields, *Progress in Physics*, (2009) no.2, 107.

[4] U. E. Bruchholz, Geometry of Space-Time, *Progress in Physics*, (2009) no.4, 65.

[5] U. E. Bruchholz, Algorithm of Nature, *ARPN Journal of Systems and Software*, **1** (2011) no.9, 280.

[6] U. E. Bruchholz, Geometric Theory of Fields: What It Means, *Int. J. Modern Theo. Physics*, **2** (2013) no.1, 13.

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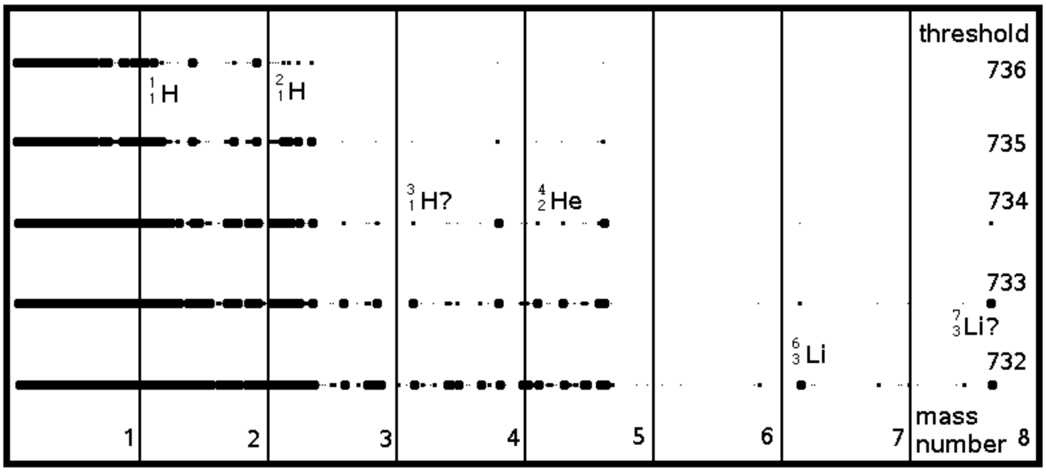

Figure 4: Tests for nuclei with mass numbers up to 8
Initial radius 4, 400 values, 4 times piled (1600 tests)

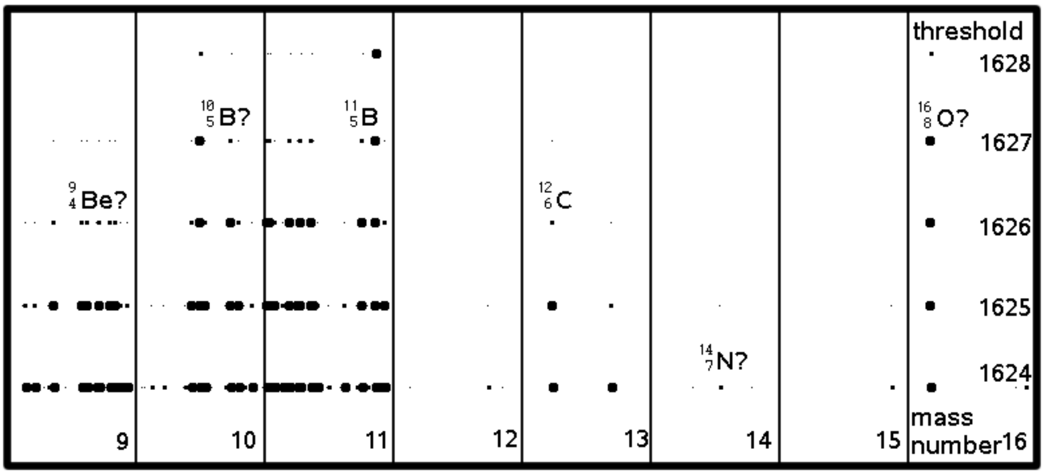

Figure 5: Tests for nuclei with mass numbers from 8 to 16
Initial radius 5, 400 values, 5 times piled (2000 tests)