Geometric Theory of Fields

Insights and Consequences

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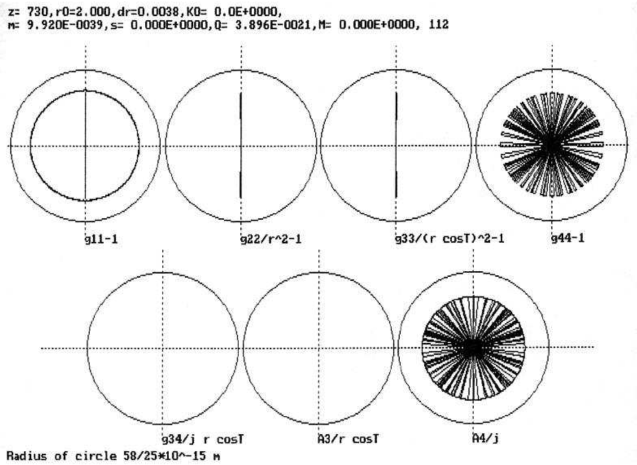

It is exposed that, contrary to common opinion, electromagnetism is purely geometrical, and the omnipresent quantization emerges from this geometry of gravitation and electromagnetism, already found by RAINICH. This requires a new understanding of the LEIBNIZ calculus. Numerical simulations using simplest method meet this requirement. Sequentially, numerical simulations according to geometric equations let see the discrete values of particle quantities. – Consequences for the understanding of causality, tunnel effects, world models etc. are raised.

The complete theory is based on the tensor equations [5]

$$R_{ik} + 3K_\circ\, g_{ik} = \kappa\, (\frac{1}{4}\, g_{ik} F_{ab} F^{ab} - F_{ia} F_k{}^a) \quad , \tag{1}$$

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

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

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. $K_\circ$ is the constant part of the RIEMANNian curvatures [2], and meaningful for global solutions, e.g. [6]. κ is EINSTEIN's gravitation constant. These equations are known as EINSTEIN-MAXWELL equations.

EINSTEIN quoted these equations already in his Four lectures [1]. As well, he quoted the covariant MAXWELL equations and the electromagnetic energy-momentum tensor. In order to give the gist of EINSTEIN's remark: If distributed charges and currents vanish, Eq. (1) meets the BIANCHI identities [2], i.e. the electromagnetic energy-momentum tensor is compatible with EINSTEIN's gravitation equation [1] *only under this condition.* The BIANCHI identities are mathematical expression of force equilibrium respectively energy conservation. Therefore, the only one resonable consequence consists in it that sources have to vanish.

We shall see that sources are replaced by integration constants in the solutions [4]. Mass, spin, charge, magnetic momentum are first integration constants. The geometry resulting from the EINSTEIN-MAXWELL equations was already found by RAINICH [3], and derived by a different method in [5].

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 [8], result in another picture [4]:

Numerical simulations using iterative, non-integrating methods lead always to a boundary at the conjectural particle radius. E. SCHMUTZER told that the singularities from analytic solutions are displaced to this boundary.[2] However, this is the half truth, because the actual singularity appears always within a geometric limit. The area within this geometric limit *according to observer's coordinates* is not locally imaged, i.e. does not exist. 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 [4].

In order to support or disprove the theory,

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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 [4, 8]), 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. Table 1 shows the reference values with a radius unit of 10^{-15}m.

	Proton	Free electron
m	2.48×10^{-39}	1.30×10^{-42}
s	2.60×10^{-40}	2.60×10^{-40}
Q	1.95×10^{-21}	1.95×10^{-21}
M	5.7×10^{-22}	3.7×10^{-19}
	Deuteron	Helium nucl.
m	4.96×10^{-39}	9.9×10^{-39}
s	5.2×10^{-40}	0
Q	1.95×10^{-21}	3.9×10^{-21}
M	1.76×10^{-22}	0

Table 1 Normalized reference values of first integration constants
m mass, s spin, Q el. charge, M magn. momentum

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 title figure shows cross-sections of a particle (here Helium nucleus) for calculated components, in which the inner curve denotes the geometric limit of the component.

The number of steps (iterations) until the first geometric limit of a component (where the absolute value of the *physical* component becomes 1) depends on the inserted values of the integration constants. Figure 1 demonstrates the strong dependences at computations with a coarse grid. Non-ambiguous tendencies (here for the charge) are to see. Computations with finer grid lead to smaller contrast of the step numbers, but the values are more precise, Fig. 2 to 5.

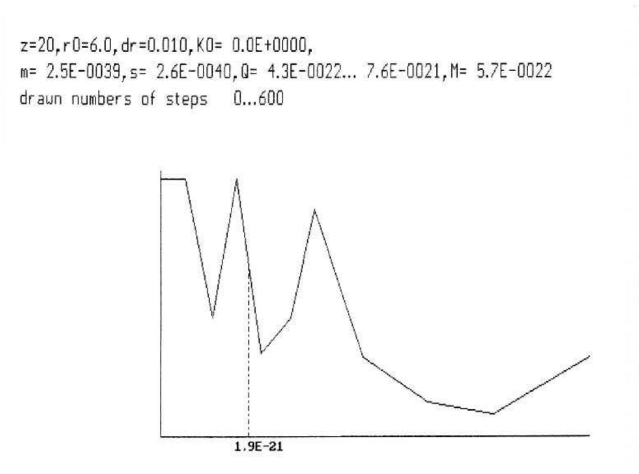

Figure 1

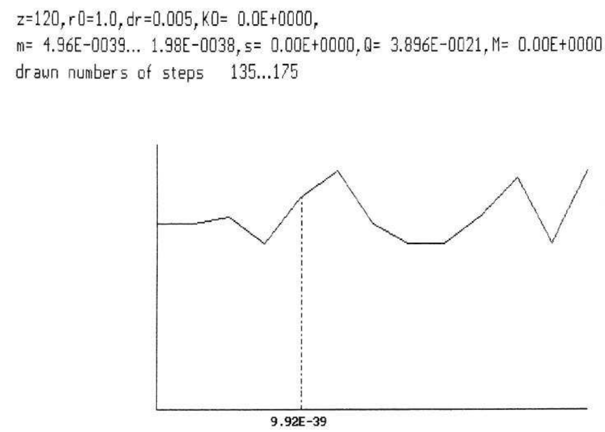

Figure 2

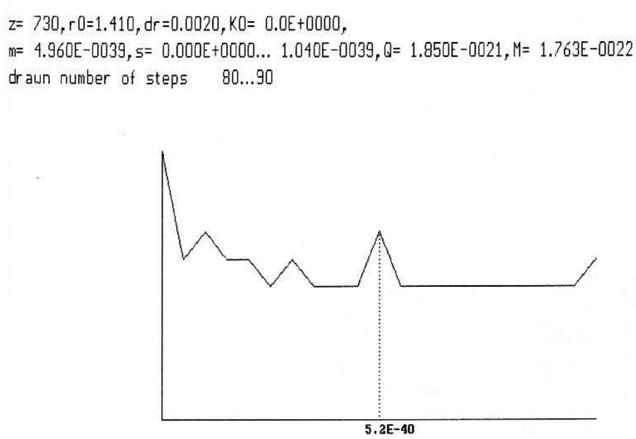

Figure 3

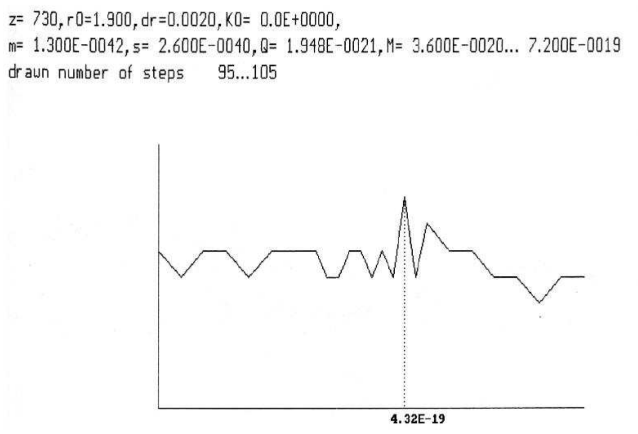

Figure 4

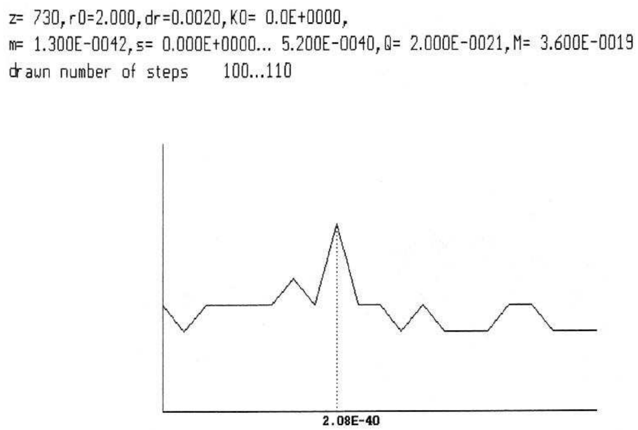

Figure 5

These first results have been achieved about 20 years ago for 11 parameters in total. Just if the error probability of the single result is more than 10%, the total error probability might be comfortably small. Later achieved robust results (across 2 to 3 parameters) are presented in [4, 8].

The success of iterative methods, where transitions to infinitely small differences do not happen, led to the insight that, solving partial differential equations, such transitions must happen first at the end of all calculations if at all.

On causality

The Einstein-Maxwell equations provide 10 independent equations for 14 components g_{ik}, A_i (where $F_{ik} = A_{i,k} - A_{k,i}$, identical with Eq. (2)). With it, causality is not given in principle. It is false to claim, a geometric approach would imply causality. Geometry has nothing to do with causality, because causality has not been geometrically defined at all. If we see something causal, it comes from approximations by wave equations. [4]

Remark on photons

The numerical simulations pertained particles, which are stationary elementary fields. Photons are a borderline case. If we assume finite extent in $ct - x, y, z$, one can qualitatively derive Planck's constant from Maxwell's equations [7]. As well, the field and the structure of the boundary are unknown. But the resting observer sees a wave with infinite extent in t and x , consistent with Special relativity. See also [9].

On wave-particle duality

The Afshar experiment [10] demonstrates that the photon is a wave for the resting observer, see above. However, numerical simulations done by Al Rabeh, and reproduced and improved by Eckardt [9] disprove any wave character of particles. (These were treated as Coulomb charges, and still generate interference pattern on a target.) Summarizingly, the wave-particle duality is disproved, see also [9].

On tunnel effects, EPR effect, and electrical conductivity

The Einstein-Maxwell equations allow structures, in which a finite distance (as the outer observer sees it) can locally become zero. That were a real tunnel with an "inner" length of zero. An event at the one side is "instantaneously" seen at the other side. A known effect, that could be interpreted this way, is the EPR effect [11]. Such tunnels might arise by accident.

This view is supported with changes of metrics by electromagnetism. Distances are locally shortened (at electric fields in direction of the field strength), what can lead to a feedback. Also lightning and electrical conductivity in general point to this direction. – More see [4].

World model

The only world model consistent with the Geometric theory of fields is the DE SITTER world. It meets the RAINICH identities (see [5]), what means there is no conflict with the electrovacuum. It is demonstrated in [6] that the DE SITTER world is supported by recent observations.

This fully geometrical world is symmetric in time, what means also a reverse time arrow. – Why do we not see antimatter, and can prove it only at a glance ? This is only explicable with the assumption that antimatter has a negative time arrow (when matter has the positive). That means: If antimatter emits photons, these meet us in our past, i.e. the photons go from us to the antimatter in our time. It is a questionable hypothesis that the background radiation be the rest of a "Big bang", which is precluded by the DE SITTER world. ROBITAILLE demonstrated that the background radiation could come from oceans [12]. It could be secondary radiation contingent on future processes.

In this context, the fiction, that dark matter consist of antimatter, does not appear as unfounded. Why do we observe dark matter exclusively via gravitation field and nothing else ? Gravitation is unipolar, and independent on the time arrow if static. Matter does not interact with antimatter, unless matter meets antimatter purely by accident.

Keywords: Theory of relativity, Numerical simulations, Riemannian geometry, Einstein-Maxwell theory, Rainich theory, Geometric field theory.

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