Comment on 5-dimensional Projective Unified Field Theory by Ernst Schmutzer published in viXra:1605.0158

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Abstract. This short letter refers to Schmutzer´s 5-dimensional Projective Unified Field Theory as a new general-relativistic covariant unification of gravitation, electromagnetism and scalarism **(**a new phenomenon of nature) with some remarks to it.

1. Introduction

In the above-mentioned theory, published in viXra:1605.0158, Prof. Schmutzer gives a short overview of his 5-dimensional Projective Unified Field Theory (PUFT) and presents the crucial physical results of this theory. Interesting applications of the PUFT can be found in viXra:1605.0206 (massive sphere), viXra:1605.0187 (cosmos) and viXra:1709.0099 (torus). Apart from taking an interest in many areas of physics, all through his life he was particularly fascinated by the idea of a Unified Field Theory.

In 1958, Schmutzer founded the research group "Relativistic Physics", thus establishing this new research discipline within the Faculty of Physics at the Friedrich-Schiller-Universität Jena (FSU). His team soon became the largest in the field of relativity and gravitation among German universities. He led this internationally well-known group of gravitational theorists until his retirement in 1993.

The highlight of the wide recognition Schmutzer`s research group enjoyed was the decision of the International Society for General Relativity and Gravitation to award its 9^{th} world congress in 1980, commemorating Albert Einstein's 100^{th} birthday 1979, to Germany and in particular to the FSU Jena. Schmutzer became the regional conference director of this international scientific event [1], with some 830 participants from more than 50 countries, supported by the scientific secretary R. Collier.

The now finalised 5-dimensional Projective Unified Field Theory (PUFT) is a general-relativistic covariant unified field theory incorporating gravitation, electromagnetism and scalarism (a supposedly new natural phenomenon, possibly dark matter).

2. History of 5-dimensionality

The first steps toward a 5-dimensional unified field theory were undertaken by Th. Kaluza (1921) [7] and O. Klein (1926) [8], who both used a 5-dimensional space to embed the 4-dimensional space-time within it.

A search began for a new type of geometry that would allow more liberties than the 4-dimensional Riemannian geometry (e.g. complex geometry, affine geometry, Finsler geometry, Weyl geometry, non-symmetric geometry, geometry with torsion, geometry with tetrads) to incorporate the electromagnetic and other fields.

From 1930 to 1933, distinguished mathematicians and theoretical physicists such as J. A. Schouten [9], D. van Dantzig [10], O. Veblen [11], B. Hoffmann [12], and, after World-War II, P. Jordan [13], G. Ludwig [14], P. A. M. Dirac [15] and their co-workers contributed to the establishment of a physics in 5-dimensional space.

3. Structure of the theory

Schmutzer's own analysis and interpretation of the works by the above-mentioned researchers inspired him to develop a new projective unified field theory based on the following mathematical principles:

1. Postulating the existence of a 5-dimensional projective space of the signature $(+,+,+,-,+)$ with 5 independent co-ordinates X^{ν} $(\nu = 1,2,3,4,5)$,
2. The mathematical content of the assumed projective space is the quantity of the homogeneous functions in it, in accordance with the usual mathematical laws of vector and differential calculus,
3. The axiomatic of the homogeneous functions is applicable for all homogeneity degrees of these functions,
4. The usual additive and multiplicative calculation laws remain valid.

Schmutzer's 5-dimensional field equations for PUFT ([2] – [5]) are constructed in accordance with the principle of simplicity so that a well-thought-out projection process from the 5-dimensional projection space to the 4-dimensional space-time lead to a physically well-established consistent differential equation system describing the three natural phenomena gravitation, electromagnetism and scalarism in full.

As a consequence of the projection from 5-dimensional projection space into 4-dimensional space-time, three coequal field complexes appear,

- a generalised gravitation field equation for the metric field g_{mn} ,
- a generalised field equation for the electromagnetic field tensor B^{ij} ,
- a new field equation for the scalaric field S .

As an example, we specify the new form of the gravitational field equation,

$$\left(R^{mn} - \frac{1}{2} R\, g^{mn} \right) - \frac{\lambda_s}{S^2} g^{mn} = \kappa_0 \left(E^{mn} + S^{mn} + \Theta^{mn} \right) \quad . \tag{3.1}$$

On the left of this field equation appears the Einstein-Tensor (in brackets) in combination with a cosmological term which is determined by the scalaric field S, on the right of (3.1) are the gravitationally interacting energy tensors, E^{mn} for the electromagnetic field, S^{mn} for the scalaric field and Θ^{mn} for all remaining fields (λ_s scalaric cosmological constant, κ_0 Einstein's gravitational constant).

In the new 4-dimensional basic laws, all additional terms which contain an S-function draw our attention to possible new effects in nature, hitherto unknown to physicists.

4. New physics

It is well-known, that from the covariant divergence of the generalised Einstein equation (3.1) follow the equations of motion for a test particle. An electrically neutral test particle will therefore move under the influence of the gravitational field g_{mn} and the scalaric field S. It can be shown that the influence of the $S-$field already leads to deviations from the Newtonian orbit of the test particle (example: the course of rotation curves of stars during their motion around the centre of the galaxy).

The scalaric field S appears in the new field equation as $S = S_0 \exp\sigma$. It has the dimension of a length, proportional to a length constant S_0. Following the PUFT theory, the value of this "elementary scalaric length" (Schmutzer) is

$$S_0 = 2\frac{e_0\sqrt{\gamma_N}}{c^2} \approx 2.76 \cdot 10^{-34} cm \quad , \tag{4.1}$$

about one order of magnitude smaller than the Planck-length

$$L_{Pl} = \sqrt{\frac{\hbar\gamma_N}{c^3}} \approx 1.62 \cdot 10^{-33} cm \quad . \tag{4.2}$$

In this equation is c the speed of light in vacuum, γ_N Newton's gravitational constant, e_0 the amount of electrical charge of the electron and $\hbar = h/2\pi$ is Planck's constant.

As a second example for new effects, we mention Schmutzer's cosmological model which is universally calculated for a spherically-symmetric distribution of matter (imitation of dark matter) and electromagnetic photon gas. The beginning of the existence of the universe happens without singularity, named "Urstart" by Schmutzer. Contrary to the Big Bang of Einstein's theory of gravitation, the initial singularity is avoided. The present Hubble parameter H_0 in Schmutzer´s cosmology reads (T_0 age of the universe, K_0 its "radius"):

$$H_0 \approx 70.26\ km/(s\cdot Mpc) \approx \frac{1}{T_0} \approx \frac{1}{13{,}83\cdot 10^9\ y} \quad , \qquad K_0 \approx \frac{c}{H_0} \approx cT_0 \approx 1.32\cdot 10^{28} cm \quad . \ (4.3)$$

This is only a small selection of interesting new conclusions deriving from Schmutzer's PUFT. The theory has been presented with user-friendly comments for further investigation and applications in a new publication by E. Schmutzer and A. Gorbatsievich [6].

5. Hints and questions

This elementary scalaric length $S_0/2 = (\sqrt{\gamma_N}/c^2)\cdot e_0$ also appears in the spherically symmetric Reissner-Nordström solution of the Einstein-Maxwell Theory, if, in addition to the mass M, the electric charge Q is the electron charge e_0. It follows that the metric of this black hole ($\sqrt{\gamma_N} M \geq Q = e_0$) is then

$$ds^2 = f\,d(ct)^2 - \frac{1}{f}(dr)^2 - r^2 d\Omega^2 \quad , \quad f = 1 - 2\,\frac{\gamma_N}{c^2}\frac{M}{r} + \left(\frac{\sqrt{\gamma_N}}{c^2}\frac{e_0}{r}\right)^2 \quad . \qquad (5.1)$$

From the perspective of quantum theory, the difference between classic scalaric length S_0 and quantum-theoretical Planck length L_{Pl} is given by the fine-structure constant $\alpha = e_0^2/\hbar c$,

$$\frac{S_0}{\sqrt{\alpha}} = 2\frac{e_0\sqrt{\gamma_N}}{c^2}\cdot\sqrt{\frac{\hbar c}{e_0^2}} = 2\sqrt{\frac{\hbar\gamma_N}{c^3}} = 2L_{Pl} \approx \sqrt{137}\cdot S_0 \approx 3.24\cdot 10^{-33} cm \quad . \qquad (5.2)$$

This is analogous to the difference between the classical radius r_e of the electron and its quantum-theoretical Compton wave length λ_c, that will also be equalised by the fine-structure constant (m_0 rest mass of the electron),

$$\frac{r_e}{\alpha} = \frac{e_0^2}{m_0 c^2}\cdot\frac{\hbar c}{e_0^2} = \frac{\hbar}{m_0 c} = \lambda_e \approx 137\cdot r_e \approx 3.86\cdot 10^{-11} cm \quad . \qquad (5.3)$$

It could therefore be assumed that a quantization of PUFT also creates a connection between S_0 and L_{Pl}. As a consequence particular to the quantization of the scalaric field S, quanta of this field function could have an integer multiple of an elementary length proportional to the Planck length.

Finally, one question remains: How can the entirety of the Salam-Weinberg theory on the unification of electromagnetism and weak interaction be incorporated into Schmutzer's scheme of a unified field theory of gravitation, electromagnetism, scalarism ?

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