„YME vs. MIE THEORY“
Consolidated page

www.fuchs-braun.com

Klaus Braun
January 9, 2022

The YME mass gap problem and Mie's purely field theory

The baseline model of Einstein's special relativity theory are the Maxwell equations. For given distributions of electric charges and currents the Maxwell equations determine the corresponding electromagnetic field. The central underlying concept is the Lorentz transformation. The original inertia law (before Einstein's gravity theory) forced to attribute physical-objective properties to the space-time continuum. Analog to the Maxwell equations (in the framework of a short distance theory) Einstein considered the inertia law as a field property of the space-time continuum.

The unknown physical parameters of the Maxwell equations

The energy tensor for electromagnetic fields is unknown for elementary particles. The laws by which the currents and charges behave are unknown. Matter is built by electromagnetic particles, but the field laws by which they are constituted are unknown, as well. From (EiA) p. 52 wequote:

„*However, the laws governing the currents and charges (in the Maxwell equations), are unknown to us. We know, that electricity exists within elementary particles (electrons, positive kernels), but we don't understand itfrom a theoretical perspective. We do not know the energetical factors, which determine the electricity in particles with given size and charge; and all attempts failed to complete the theory in this directions. Therefore, if at allwe can built on the Maxwell equations, we know the energy tensor of electromagnetic fields only outside of the particles*“.

From (DiP) we quote:

"*The Lorentz model of the electron as a small sphere charged with electricity, possessing mass on account of the energy of the electric field around it, has proved very valuable in accounting for the motion and radiation of electrons in a certain domain of problems, in which electromagnetic field does not vary too rapidly and the accelerations of the electrons are not too great. .... The departure from electromagnetic theory of the nature of mass removes the main reason we have for believing in the finite size of the electron. It seems now an unnecessary complication not to have the field equations holding all the way up to the electron's centre, which would then appear as a point of singularity. In this way we are led to consider a point model for the electron*."

The Yang-Mills Equations and the mass gap

The classical Yang-Mills theory is a generalization of the Maxwell theory of electromagnetism where the chromo-electromagnetic field itself carries charges. As a classical field theory the Maxwell equations have solutions which travel at the speed of light so that its quantum version should describe the massless particles, the „gluons“. However, the postulated phenomenon of color confinement permits only bound states of gluons, forming massive particles.This is the mass gap. Another aspect of confinement is asymptotic freedom which makes it conceivable that quantum Yang-Mills theory exists without restrictiont o low energy scales.

In other words, the YME Millennium problem is about an appropriate mathematical model to govern the current "mass gap" of the YME, which is the difference in energy between the vacuum and the next lowest energy field.

The proposed Hilbert scale based quantum field model isabout an generalized variational representations of the considered PDE (in this case the Maxwell equations) based on the H(1/2) inner (energy) product, whichis a generalization of the H(1) Dirichlet integral inner product. The Extended energy Hilbert space allows a decomposition into the compactly embedded (coarse grained) standard H(1) energy Hilbert space and a complementary closed sub-space of H(1/2). The corresponding dual Hilbert space H(-1/2) of H(1/2) contains the quantum elements carrying a sum of kinematical and potential energy, correspondingly governed by the related energy space decomposition in the considered physical situation/ PDE system.

The extended Maxwell equations in the proposed Hilbert scale framework provides the missing laws by which the currents and charges behave. This is very much in line with Mie's theory.

The Mie theory

A more general theory ofelectrodynamics has been proposed by Mie, by which it seems possible to derive the matter from the field.

The requirement leading to the Mie equations is that the mechanical law must follow from the field equations. Therefore, the Mie equation is fully analogous to that of the fundamental law of mechanics. In the static case that is, the electric force is counterbalanced in the ether by the concept of an „*electric pressure*“. It is the essential differentiator to the Lorentz equations, where there is no law that determines how the potentials depend on the phase-quantities of the field and on the electricity; there is only a formula giving the density ofthe mechanical (*ponderomotorische*) force and the law of mechanics, which governs the motion of electrons under the influence of this force.

Mie’s theory resolves the problem of matter into a determination of the expression of the Hamiltonian function in terms of four quantities and the laws for the field may be summarised in a Hamilton’s principle.

(WeH): "*G. Mie in 1912 pointed out a way of modifying the Maxwell equations in such a manner that they might possibly solve the problem of matter, by explaining why the field possesses a granular structure and why the knots of energy remain intact in spite of the back-and-forth flux of energy and momentum. The Maxwell equations will not do because they imply that negative charges compressed in an electron explode; … The preservation of the energy knots must result from the fact that the modified field laws admit only of one state of field equilibrium … The field laws should thus permit us to compute in advance charges and mass of the electron and the atomic weights of the various chemical elements in existence. And the same fact, rather than contrast of substance and field, would be the reason why we may decompose the energy or inert mass of a compound body (approximately) into the non-resolvable energy of its last elementary constituents and the resolvable energy of their mutual bond. …. At a certain stage of the development it did not seem preposterous to hope that all physical phnomena could be reduced to a simple universal field law (in the form of a Hamiltonian principle).*"

In mechanics, a definite function of action corresponds to every given mechanical system and has to be deduced fromthe constitution of the system. Mie’s theory is only concerned with a single system, the world. This is were the real problem of matter takes its beginning: to determine the Mie „world-function of action“, belonging to the physical world.

The proposed gravity and quantum field model is basically an enhanced Mie electrodynamic overcoming the above difficulty which is basically caused by a missing truly geometric structure of the underling manifolds w/o any conceptual relationship to all possible mathematical solution of the Mie equations. Therefore, the enhancement is concerned with a replacement of the manifold framwork by a Hilbert space, where its inner product induces a corresponding norm and where an existing hermitian operator induces a corresponding energy norm, governing e.g. least action or energy minimization formalisms.

The common baseline with the proposed NSE solution in line with the proposed YME solution is related to the physical notion "*pressure*", which has the same unit of measure than a "*potential difference*". The common additional conceptual new element is the fact that a "*potential difference*" becomes now an intrinsic element of the corresponding PDE systems governed by the closed "potential energy" ("ground state", "internal energy") sub-space.

References

(DiP) Dirac P., "*Classical theory of radiating electrons*", Proc. Roy. Soc. London, 167, (1938) 148-169

(EiA) Einstein A., "*Grundzüge der Relativitätstheorie*", Vieweg & Sohn, Braunschweig, Wiesbaden, 1992

(WeH) Weyl H., Philosophy of Mathematics and Natural Science, Princeton University Press, Princeton and Oxford, 2009