Article

Subquantum Model, Caianiello's Phase Space, Space-Time Geometry & Ether

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ABSTRACT

In the standard model of particle physics, the relativistic field theory disregards the essential subquantum information. We have built model of elementary particles consisting of two systems of subquantum particles spinning in opposite directions. We further discusss here the subquantum model, Caianiello's phase space, space-time geometry & ether.

Key Words: subquantum model, elementary particle, phase space, space-time geometry, aether.

37. OUR MODEL OF 'ELEMENTARY' PARTICLE VS THE STANDARD MODEL

We built a model of 'elementary' particle (consisting of two systems of subquantum particles spinning in opposite directions) exclusively from the physical information identified in the terms of the equations describing Dirac particles and photons. We did it (Secs. 28 to 36), according to the principle of the physical determination of equations, just validated in the relativistic quantum theory (Sec. 27). No additional conjecture was needed to obtain this model. So, for any new theoretical or experimental information to contribute to the 'standard model' of 'elementary' particle, it must be in accord with this information, not vice versa. Although incomplete (e.g., by the lack of predictions on the electric charge), this model is basic. It is important by that i) all ordinary matter is composed of Dirac particles and photons, and ii) disclose the nature of mass (Sec. 28).

As concerns the standard model of particle physics, it is a relativistic field theory which disregards the principle of the physical determination of equations, so essential subquantum information. The model of 'elementary' particle which it predicts is at least incomplete. The theory has no mechanism accounting for the particles mass. The claim that the neutron and proton masses arise mostly from strong forces that hold the quarks together seems ridiculous, as long as the mass of the relativistic neutrons and protons, and the mass of the relativistic electrons obey the same relativistic formula of mass. A true, main contribution of the strong forces to the neutron and proton mass should make the relativistic neutron and proton mass obey a formula differing from that obeyed by the relativistic electron mass, which experiments deny. One claiming that the nucleons masses "arise mostly from strong forces that hold the quarks together" [60], must admit that the same subquantum particles with a complex structure really constitute both nucleons and electrons.

On way of consequence, unlike the standard model, which has no mechanism accounting for the particle mass, our model of 'elementary' particle provides the sub-quantum nature of mass the same for all Dirac particles (it is to be further searched for all quantum particles), as well as a subquantum experimental technique -challenging that consisting in accelerating particles- of changing the mass, so proving this nature.

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38. REMARK CONCERNING CAIANIELLO'S PHASE SPACE

Our derivation of the Lorentz transformation as a complementary time-dependent coordinate transformation proves that the Minkowski space-time is an operational entity, not a physical one. Mixing coordinates and times, the Lorentz transformation assures the invariance of its defining metric. Due to their dependence on time, physical quantities form four-vectors and four-tensors. Thus the Minkowski space-time is a suitable rigorous framework for describing the physical reality filling space.

Beside the Minkowski space-time there is the four-space, also formal, associated to the four-momentum $p^\mu=(p,E/c)$ just as the former was attached to the four-vector $x^\mu=(x,ct)$. This is the energy-momentum space which Caianiello joined with the Minkowski space-time into an eight-dimensional space, and which metric enabled him to deduce the maximal acceleration $\mathbf{a}_M$ [61]. The endowing of phase space with a metric is raised by the spinning systems of subquantum particles, just as it is the quantum behaviour of the particles.

39. SUBQUANTUM DETERMINATION OF THE SPACE-TIME GEOMETRY

Our derivation of the maximal acceleration $\mathbf{a}_M$ as a subquantum acceleration (see Sec. 29) reconciles the $\mathbf{a}_M$ derived by Caianiello as a 'macroscopic' quantity with its dependence on $\lambda\!\!\!^-_C$. It also explains the factor 2 formerly inserted 'for convenience' in $\mathbf{a}_M$ [53].

But, unlike Caianiello -who needed to postulate that a quantum particle is an extended object for getting $\mathbf{a}_M$-, we had at our disposal our model of 'elementary' particle, deduced by applying the principle of the physical determination of equations to the relativistic quantum theory (Sec. 28). It is this model of 'elementary' particle which predicts, by the diagram in Fig. 13, the Schwartzschild radius $R_{Sc} = 2Gm_o/c^2$, where G is the gravitational constant and m_o is the particle rest mass, according to the relationship

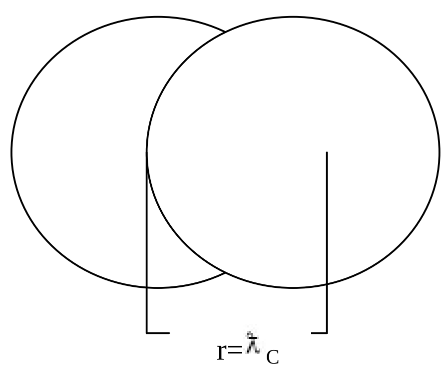

Figure 13.

$$2Gm_o^2/r^2=m_oc^2/r,$$

with $r=\lambda\!\!\!^-_C$ [51].

As the stability of the coupled, oppositely spinning systems of subquantum particles can be related to the stability of two spinning physical systems interacting by gravitational waves (by the validity of the theory of such an interaction [62-63], no matter of the level of structure of matter to which the systems belong), a curved space-time associates to any massic 'elementary' particle.

The metric of this space-time enabled Caianiello to succeed in reproducing the position-momentum commutation relations by embedding a hermitian metric in the phase space [64].

The appearance of components of the metric tensor defining weak gravitational waves in its metric [64-65] suggests the subquantum nature of gravitation and questions the quantization of the gravitational fields. The identification of the $\mathbf{a}_{\mathrm{M}}$ derived from the position-momentum and time-energy uncertainty relations with the acceleration of the spinning systems of subquantum particles suggests that the quantum rules must be determined by rules governing the subquantum structure. The most important sub-quantum rule seems to govern the coupling between the ω's of the spinning systems of subquantum particles. So the physical information derived from the geometry of the curved space-time originates in the determination of this space-time by the subquantum structure of matter. Both, the derivation of $\mathbf{a}_{\mathrm{M}}$ by Caianiello [51], and the regaining of Sacharov's absolute maximal temperature of thermal radiation in terms of $\mathbf{a}_{\mathrm{M}}$ [66] are only very few examples of such a determination. By the light-speed principle, we meet in Einstein's special relativity theory *c* with meaning of speed of a physical signal used as a tool, and of speed governing the subquantum world.

40. SOME CONSIDERATIONS ON CURVED SPACE-TIME AND WEAK GRAVITATIONAL WAVES

The only connection of the curved space-time with the macroscopic physical world concerns the motion of bodies and particles along geodesics around massive bodies. The non-Euclidian geometry of the space-time just assures the description of such motions, telling nothing about the nature of mass, 'gravitational energy' and the physics of the gravitational interaction. All these follow from special relativity theory via relativistic quantum theory (see, e.g., Secs. 27, 28). The curved space-time, like the Minkowski space-time in the special relativity theory, has just an operational origin. A sudden breaking in the state of energy of a massive body is described by a free Riemann tensor defining a weak gravitational wave as a physical entity (Sec. 22 (Sec. 3)), but this does not support the claim that the Riemann tensor is a true physical force exerted by the wave upon test particles of unit mass [67]. The gravitational wave is just an amount of energy traveling through empty space at a given speed -let it be c. Some comments on generating and detecting weak gravitational waves we gave in [68-82].

The effects of the gravitational field of a massive body upon 'elementary' particles, particularly upon photons, suggests the subquantum nature of the wave energy. What was named 'gravitational energy' is subquantum energy. Otherwise such effects would not exist. This conjecture coincides with our derivation of the relativistic mass as the coupling constant of the systems of subquantum particles constituting Dirac particles (Sec. 28), and requires for checking the general validity of this result. A true generation and detection of weak gravitational waves as carriers of subquantum energy[1] becomes feasible in laboratory conditions [82-91] by altering the mass of some quantum particles [92]. This because the potentials of the gravitational waves depend on the time rate of change of the mass density [93]. The claim that the curved space-time would be "endowed with physical qualities" [31] was misleading and remains as such.

[1] The term 'subquantum' defines the level of structure of matter at which must be acted to release the energy, as well as to possible peculiarities of the energy released by such an action.

41. ON THE ETHER

By the negative result of the Michelson-Morley experiment, Einstein felt entitled to deny ether and use in his special relativity theory light signals traveling to and fro through space.

However, a subquantum nature of the hypothetical physical entity named ether may explain the lack of experimental evidence, as well. So long as the light's photons are stable particles, no experiment manipulating light signals traveling through space will give evidence for the ether. Even if filled with subquantum energy, space behaves as empty space with respect to light. So Einstein's decision to use light signals as if space was empty was right. It validates our tracing of radius vectors by light, too.

An experimental checking of the hypothetical subquantum nature of the ether will become feasible just after experiments on releasing subquantum energy will be successful.

42. TESTING EXPERIMENTS AND POTENTIAL APPLICATION TO RADICALLY NEW TECHNOLOGIES

'Elementary' particles get currently excited by accelerating to relativistic speeds. No explanation of the phenomenon was provided. The model of 'elementary' particle, just obtained in Secs. 28-36, provides a subquantum origin of mass which enables us to propose a challenging techniques of exciting particles, namely by altering the coupling of their spinning systems of subquantum constituents. Because it is presumable that magnetic momenta are associated to these spinning systems just as they are associated to the spin of the particles, adequate patterns of magnetic fields can act directly upon these magnetic momenta. There results a change in the angles made by the frequencies $\boldsymbol{\omega}$ of the systems with the particle spin **S**, and according to Eqs. (29), (30) and the 'precession' equation

$$d\mathbf{S}/dt = \boldsymbol{\omega} x \mathbf{S},$$

a mass change simultaneous with a spin time rate of change.

The energy gained by excitation can manifest by interaction or be released for well-defined ratios □/□ of the spinors describing the coupled systems of subquantum particles (emission ratios). So are obtained both excited particles and sources of subquantum energy. Some of the ratios □/□ can be given in terms of the speeds reachable by particles under acceleration. The releasable amounts of energy are absolute quantities. They can overcome the upper limits set by the feasible accelerating facilities. It is however a hard experimental work to subquantumly excite 'elementary' particles, investigate their interaction and change into each other (as suggested by the systems of subquantum particles predicted to exist in both Dirac particles and photons) when excited, and the effect which the radiated subquantum energy [13, 16, 17, 94, 95] may have upon exciting, destroying or condensing matter (especially the nuclear charge of the missiles). Even if the structure of the nucleons is actually more complex than it is predicted by the Dirac equation, the presence of e^- and e^+ in their interchange is enough for the subquantum energy released by e^- and e^+ to excite nucleons and produce such effects. There is a suitable energy for breaking any sort of atomic nucleus.

Radically new technologies exploiting effects of the subquantum energy become feasible by altering the internal coupling of the basic particles constituting matter. Some of them, like condensing matter (cold fusion [96], superconductors at normal temperatures [97]), most powerful lasers and hypermagnets are foreseeable. There is almost nothing in common between the actual trend in these fields and the new trend. Other technologies are hard to be imagined now. Unknown rules which to govern the alteration of the coupling of the systems of subquantum particles, and so the quantum behaviors of matter are to be disclosed experimentally. Even Pauli's exclusion principle may probably be altered experimentally [63]. A rough calculation shows that one cubic centimeter of a metal can release an energy of 10^{13}J [98].