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A SYMMETRIC ADVENTURE BEYOND THE STANDARD MODEL

Isotopic Field-Charge Spin Conservation in the Electromagnetic Interaction

György Darvas

Physicist, philosopher (b. Budapest, 1948).

Address: Symmetrion, 29 Eötvös St., Budapest, H-1067 Hungary; E-mail: darvasg@iif.hu; http://members.iif.hu/darvasg/.

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It is demonstrated — based on examples of the gravitational and inertial masses, as well as those of the Coulomb- and Lorentz-type electric charges — that the *sources* of the individual fields (their field-charges) appearing in the scalar and vector potentials can be regarded as different physical quantities. They can be considered as *isotopic pairs* of each other. Therefore they are given the name *isotopic field-charges*. Being qualitatively different quantities, the members of these pairs must differ in one of their attributes. This attribute characterises a physical property of those isotopic pairs.

It is further shown that this property behaves in a way similar to that of *spin* and of *isotopic spin*. Based on that similarity, this property is given the name *isotopic field-charge spin*. It is a conserved property, which is invariant under rotations characterised by a symmetry group. The invariance is interpreted as commutativity of the isotopic field-charge pairs under rotation of the isotopic field-charge spin in an abstract field. That abstract field is identified and shown to be different from those fields in which the analogously behaving spin and isotopic spin are rotated.

The individual members of the isotopic field-charge pairs may interact. One member of the field-charge pairs appears in the (scalar) potential part of the Hamiltonian of the interacting system, and the other in the kinetic part of the Hamiltonian of that system. Therefore, the distinction between the isotopic field-charge pairs is interpreted in their relation to a kinetic field. That relation is described in the paper.

Among the conclusions is the prediction of a boson family that mediates this interaction among members of the interacting system. Now, any conservation law involves the quanta of the field. Since the conservation of the isotopic field-charge spin takes place in a kinetic field, these mediating bosons are the quanta of this *kinetic field*. The quanta of the kinetic field carry the isotopic field-charge spin. The isotopic field charge spin doublet, as a conserved quantity, is related to the two isotopic states of the field-charges; and the associated operators induce transitions from one member of the doublet to the other. In this way the conservation of the isotopic field-charge spin is proprely described, along with the mechanism of the interaction between the isotopic field-charges.

These general considerations are exemplified in their application to a concrete physical interaction — the electromagnetic. Some of the new conclusions are presented in the order sketched below.

Following a general introduction on physical symmetries, the lecture consists of two main parts. The first part introduces the isotopic field-charge spin model. The second part applies this model to the electromagnetic interaction.

The first part gives a short introduction to the prehistory of the isotopic field-charge spin model, the role of symmetry principles in the history of scientific thinking, and the birth of the idea of the spin conservation laws. Then it discusses, how spin served as an archetype for the introduction of analogous phenomena that obeyed similar invariance properties. As a next step the lecture discusses the role of symmetry violation in the example of interactions between electric charges, and explains how this asymmetry led to the idea of isotopic field-charges. This idea shows that the charges which serve as *sources* of the physical fields, appear with *different* attributes in the potential and the kinetic parts of the Hamiltonian of physical systems. Such same sources with those different attributes can therefore be considered as *isotopes* of each other. The paper sketches a phenomenological model of the commutation between the isotopes of field-charges, and goes on to demonstrate how certain invariances are violated in the presence of the assumed isotopic field-charges. Then, it shows that the lost symmetry can be restored through the inclusion of another invariance. The new invariance involves the introduction of the isotopic field-charge spin, a physical property that distinguishes the two isotopes of the field-charges, and is subject to the same symmetry group as that of spin and isotopic spin. It is shown that the isotopic field-charge spin is a conserved property, and that its conservation is subject to invariance under rotations in a kinetic gauge field. The last section of the first part discusses how the isotopic field-charge spin invariance changes our physical world view.

The second part explains how the distinction between isotopic field-charges and the assumption of a kinetic field can be applied in quantum-electrodynamics. It inserts the distinct masses and electric charges, as well as a kinetic field, into the Dirac equation of QED, and discusses the consequences of the extended Dirac equation. There is explained that the Standard Model remains intact — using the example of the application of the isotopic field-charge spin model to the electromagnetic interaction — but this extension of the theory leads to new conclusions among conditions that go beyond the Standard Model. The paper discusses four of these new conclusions. (1) Derivation of the extended Schrödinger equation from the extended Dirac equation; (2) Explanation on why the wave function of a free electron cannot run away without limits; (3) Interpretation of the electric moment; and (4) Prediction and theoretical appearance of the quanta of the kinetic gauge field — the dions — that are assumed to mediate the exchange of the isotopic electric charge spin.

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