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MASS AND GEOMETRY

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Abstract

A possibility to construct a generalization of the Standard Model which contains a limiting mass M for its fundamental constituents is investigated. The parameter M is considered as a new universal physical constant of Nature and, therefore, is called the **fundamental mass**. It is introduced in a purely **geometric** way, like the velocity of light as a maximal velocity in the special relativity. If one chooses the Euclidean formulation of quantum field theory, the adequate realization of the limiting mass hypothesis is reduced to the choice of the de Sitter geometry as the geometry of the 4-momentum space. All fields defined in de Sitter p-space in configurational space obey five dimensional Klein-Gordon type equation with the fundamental mass M as a mass parameter. The role of dynamical field variables is played by the Cauchy initial conditions given at $x_5 = 0$, guaranteeing the locality and gauge invariance principles. The formulation of the theory of scalar, vector and spinor fields corresponding to the geometrical requirements is considered in some detail. By a simple example it is demonstrated that the spontaneous symmetry breaking mechanism leads to renormalization of the fundamental mass M. A new geometric concept of the chirality of the fermion fields is introduced. It would be responsible for new measurable effects at high energies $E \tau M$. Interaction terms of a new type are revealed due to the existence of the Higgs boson. The most intriguing prediction of the new approach is the possible existence of exotic fermions with no analogues in the SM, which may be a candidate for dark matter constituents.

(The present talk is based on the paper “Towards a Maximal Mass Model” by V.G. Kadyshevsky, M.D. Mateev, V.N. Rodionov, and A.S. Sorin; hep-th/30.08.2007, CERN-TH/2007-150)