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A Geometrical Meaning of the Electron Mass from Breakdown of Lorentz Invariance

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We discuss the problem of the electron mass in the framework of Deformed Special Relativity (DSR), a generalization of Special Relativity based on a deformed Minkowski space (*i.e.*, a four-dimensional space-time with metric coefficients depending on the energy). We show that, by such a formalism, it is possible to derive the value of the electron mass from the space-time geometry via the experimental knowledge of the parameter of local Lorentz invariance breakdown, and of the minkowskian threshold energy $E_{0,em}$ for the electromagnetic interaction. We put forward the suggestion that mass generation can be related, in DSR, to the possible dependence of mass on the metric background (*relativity of mass*).

1 Introduction

The problem of the mass spectrum of the known particles (leptons and hadrons) is still an open one from the theoretical side. As a matter of fact, the Standard Model of electromagnetic, weak and strong interactions is unable to say why a given particle does bear that given (experimental) mass. As to the carriers of the four fundamental forces, symmetry considerations would require they are all massless. However, it is well known that things are not so simple: weak quanta are massive. It is therefore necessary, in the framework of the Glashow-Weinberg-Salam model of electroweak interaction, to hypothesize the Goldstone mechanism, able to give weak bosons a mass by interaction with the (till now unobserved!) Higgs boson.