The Minkowski Metric and Beyond

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It is stated in many textbooks that any metric appearing in general relativity should be locally Lorentzian that is of the form $\eta_{\mu\nu} = \text{diag}\ (+1, -1, -1, -1)$, this is usually presented as an independent axiom of general relativity, which cannot be deduced from other assumptions. The meaning of this assertion is that a specific coordinate (the temporal coordinate) is given a unique significance with respect to the other spatial coordinates. In a previous work [1,2,3,4] it was shown that the above assertion is a consequence of the requirement that the metric of empty (or almost empty) space should be linearly stable and need not be assumed. However, it was conjectured that at a high density the above theorem does not hold [5]. This means that for high density regions in space time such as the very early universe, black holes and even at the very near vicinity of elementary particles the metric may indeed by Euclidean $\eta_{\mu\nu} = \text{diag}\ (+1, +1, +1, +1)$. Having in mind the early universe scenario, we calculated [6,7] the probability density function of a canonical ensemble of Euclidean and Lorentzian particles as function of temperature. We have shown how the Euclidean canonical ensemble provides an explanation of cosmological inflation, that is the rapid expansion and thermalization of the very early universe, but without assuming an ad-hoc scalar field. In a recent paper [8] we have described a complete mathematical model of cosmology possessing both an Euclidean (early universe) and Minkowskian (late universe) sectors, which is a solution of the general relativity field equations.

Keywords: general relativity; Minkowski metric; Euclidean metric; superluminality; cosmological inflation

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