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New tetrads in Riemannian geometry and new ensuing results in group theory, gauge theory and fundamental physics in Einstein-Maxwell spacetimes.

A new technique is presented in order to build tetrads in a 4-dimensional Einstein-Maxwell spacetime. These tetrads have special useful properties in relativity and also particle physics. A new fundamental result is proved in group theory. The group $SO(2)$ (spatial rotations) is isomorphic to the group $SO(1,1)$ (boosts) plus two kinds of discrete transformations. That is, a compact group is isomorphic to a non-compact group plus two kinds of discrete transformations (A. Garat, J. Math. Phys. 46, 102502 (2005)). The electromagnetic local gauge group is proved to be isomorphic to the local group of transformations of these particular kind of tetrads. Therefore, establishing a concrete link between internal and spacetime local groups of transformations. These new tetrads also diagonalize the electromagnetic stress-energy tensor for non-null electromagnetic fields, any stress-energy tensor, in a general, covariant and local way. These new tetrads also introduce maximum simplification in the Einstein-Maxwell differential equations and also introduce maximum simplification in the expression of the electromagnetic field itself, in any curved four-dimensional Lorentzian spacetime, allowing for the identification of its degrees of freedom in two local scalars.

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