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New tetrads in Riemannian geometry and new ensuing results in group theory, gauge theory and fundamental physics, in particle physics, general relativity and astrophysics.

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A new technique is presented in order to build tetrads in four-dimensional Lorentzian spacetimes. These tetrads have special useful properties in general relativity, astrophysics 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. One of them is not Lorentzian. That is, a compact group is isomorphic to a non-compact group plus two different kinds of discrete transformations (1;2). 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 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. These tetrads introduce simplification in spacetime evolution algorithms, specially in astrophysical situations related, for example, to neutron stars (3). This new tetrad can be applied and introduce simplification in the analysis of astrophysical relativistic problems where vorticity is present through the Carter-Lichnerowicz equation (4).

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Author: GARAT, Alcides (Former Professor at Universidad de la Republica, Montevideo, Uruguay.)

Presenter: GARAT, Alcides (Former Professor at Universidad de la Republica, Montevideo, Uruguay.)

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