New Vacuum Solutions for Quadratic Metric-affine Gravity

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Abstract

In this talk we will present our previous results that arose from PhD research together with certain aspects of current and future research.

We deal with *quadratic metric–affine gravity*, which is an alternative theory of gravity. We present *new vacuum solutions* for this theory and attempt to give their *physical interpretation* on the basis of comparison with existing classical models.

These new explicit vacuum solutions of quadratic metric–affine gravity are constructed using *generalised pp-waves*. A classical pp-wave is a 4-dimensional Lorentz–ian spacetime which admits a non–vanishing parallel spinor field. We *generalise* this definition to metric compatible spacetimes with torsion, describe basic properties of such spacetimes and eventually use them to construct new solutions to the field equations of quadratic metric–affine gravity.

The physical interpretation of these solutions we propose is that these new solutions represent a *conformally invariant metric–affine model for a massless elementary particle*. We give a comparison with a classical model describing the interaction of gravitational and massless neutrino fields, namely *Einstein-Weyl theory*.

Finally we discuss the possibilities of expanding this area of research to more general classes of spacetimes and several other directions our future research might take, such as teleparallelism and rotational elasticity.