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Formulation in terms of two component spinors of the theory of classical Proca fields in curved space-times without torsion

The theory of classical Proca fields in curved spacetimes without torsion is presented. In particular, the wave equation for a Proca potential is deduced. A two-component spinor version of the theory is subsequently exhibited on the basis of the use of certain calculational techniques that are already available in the literature concerning the spinor formalisms of Infeld and van der Waerden. Then, it will be shown that no couplings between Proca fields and photons coming from curvatures ultimately occur in the spinor wave equations for the theory. However, the procedures for deriving such wave equations produce a new coupling term which involves an Infeld-van der Waerden affine potential and a Proca potential. Additionally, these procedures suggest the implementation of a subsidiary condition that carries the covariant divergence of a Proca potential and the skew part of a potential coupling term. One of the motivations for elaborating the work comes from the absence from the literature of the theory to be described here. The present work will hereby presumably fill in the gap related to the absence from the literature of any detailed formulation of the theory of Proca fields in General Relativity.

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