

On the mathematical structure and hidden symmetries of the Born-Infeld field equations

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Abstract

In this work the mathematical structure of the Born-Infeld field equations was analyzed from the point of view of the symmetries. To this end, the field equations were written in the most compact form by mean quaternionic operators constructed according to all the symmetries of the theory, including the extension to a non-commutative structure. The quaternionic structure of the phase space was explicitly derived and described from the hamiltonian point of view, and the analogy and similarities between the BI-theory and the Maxwell (linear) electrodynamics in a curved space-time was explicitly shown. Our results agrees with the observation of Gibbons and Rasheed that there exists a discrete symmetry in the structure of the field equations that is unique in the case of the nonlinear electrodynamics of Born-Infeld.