

THE DYNAMICS OF THE FIELD OF LINEAR FRAMES AND GAUGE GRAVITATION

JAN J. SŁAWIANOWSKI and AGNIESZKA MARTENS

*Institute of Fundamental Technological Research, Polish Academy of Sciences
5^B, Pawińskiego Str., 02-106 Warsaw, Poland*

Abstract. The paper is motivated by gauge theories of gravitation and condensed matter, tetrad models of gravitation and generalized Born-Infeld type nonlinearity. The main idea is that any generally-covariant and $GL(n, \mathbb{R})$ -invariant theory of the n -leg field (tetrad field when $n = 4$) must have the Born-Infeld structure. This means that Lagrangian is given by the square root of the determinant of some second-order twice covariant tensor built in a quadratic way of the field derivatives. It is shown that there exist interesting solutions of the group-theoretical structure. Some models of the interaction between gravitation and matter are suggested. It turns out that in a sense the space-time dimension $n = 4$, the normal-hyperbolic signature and velocity of light are integration constants of our differential equations.

1. Introduction

No doubt, the standard General Relativity based on the Hilbert-Einstein action functional, perhaps with an extra introduced cosmological term, is a most adequate relativistic theory of gravitational phenomena in the macroscopic and cosmic scale. It is both so-to speak intrinsically aesthetic and confirmed with an impressive accuracy by experimental data. Nevertheless, there are certain shortcomings when trying to apply it to the microscopic range of phenomena. It is a well-known historical fact that there is an intriguing discrepancy between General Relativity and quantum physics. There is still no good quantum version of this theory, and besides, it seems to be non-renormalizable in a rather notorious way. The problem did not exist before the advent of quantum theory, first of all before the theory of quantized fields was developed. There is also another, more modern circumstance which seemed to raise the idea of modifying General Relativity so as to make it