

COVARIANT HAMILTONIAN FIELD THEORY

J. Struckmeier, A. Redelbach;

International Journal of Modern Physics E, Vol. 17, No.3 (2008) 435-491;

PACS numbers: 11.10.Ef, 11.15Kc;

Abstract:

A consistent, local coordinate formulation of covariant Hamiltonian field theory is presented. Whereas the covariant canonical field equations are equivalent to the Euler-Lagrange field equations, the covariant canonical transformation theory offers more general means for defining mappings that preserve the form of the field equations than the usual Lagrangian description. It is proved that Poisson brackets, Lagrange brackets, and canonical 2-forms exist that are invariant under canonical transformations of the fields.

The technique to derive transformation rules for the fields from generating functions is demonstrated by means of various examples. In particular, it is shown that the infinitesimal canonical transformation furnishes the most general form of Noether's theorem. We furthermore specify the generating function of an infinitesimal space-time step that conforms to the field equations.