Geometrical framework of gauge theories

Marcin Zajac
University of Warsaw
marcin.zajac@fuw.edu.pl

Manuel de Leon
ICMAT
mdeleon@icmat.es

In classical field theory fields are represented by sections of the fibered bundle $E \to M$. The configuration space of the theory is a bundle of first jets $\mathsf{J}^1 E$ same as a tangent bundle $\mathsf{T}M$ is in mechanics. However, there exist several geometrical formulations of classical field theory where most of them are usually associated with some extended symplectic structures (multisymplectic structures, k-symplectic structures, k-cosymplectic structures etc.) on manifolds. One of the approach based on the so-called multisymplectic structures depends on the construction of Poincare-Cartan forms on the Lagrangian side and Hamilton-De Donder-Weyl equations on the Hamiltonian one.

This very general picture may be usually simplified when we consider some particular case of field theory. For instance, in a case of gauge theories the bundle of fields is a bundle of connections in a principal bundle $P \to M$. In my talk I will present main geometrical aspects of gauge (especially Yang-Mills type) field theories and its relations to the general formalism.