

Dynamical principal bundles and Kaluza-Klein models

jeudi 26 septembre 2024 15:00 (1 heure)

I will present a family of models, based on variational problems defined on fields on manifolds, the classical solutions of which lead to an at least locally principal bundle structure on the given manifold. Moreover each critical point of such models allows us to recover solutions of gauge fields theories such as Yang-Mills or Einstein gravity equations. The ‘discovery’ of these models followed from a multisymplectic approach to gauge theories.

In this talk I will focus on a Lagrangian action, the critical points of which lead to solutions of the Einstein-Yang-Mills equations, in the spirit of Kaluza-Klein theories. The novelty is that the a priori fiber bundle structure hypothesis is not required: fields are defined on a “space-time” Y of dimension $4 + r$ without any a priori principal bundle structure, where r is the dimension of the structure group. If the latter group is compact and simply connected, to each solution of the Euler-Lagrange equations it corresponds a 4-dimensional pseudo-Riemannian manifold X (which can be interpreted as our usual space-time) in such a way that Y acquires a principal bundle structure over X equipped with a connection. Moreover the metric on X and the connection on Y are solutions of the Einstein-Yang-Mills system. If the structure group is $U(1)$ (the case which corresponds to the Einstein-Maxwell system) the situation is slightly degenerated and supplementary hypotheses are necessary.

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