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General relativity as a canonical gauge theory

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It is widely accepted that the fundamental laws of nature should follow from an action principle. This holds in particular for the laws determining the dynamics of the space-time geometry. The general principle of relativity requires the action principle to be maintained in its form under the transition from one reference frame to another, possibly non-inertial frame of reference. The particular subset of transformations of a system's dynamical variables that maintain the form of the action principle
comprises the group of canonical transformations. By their construction, canonical transformations are defined by "generating functions".

In this talk, a generating function will be presented that defines the given mapping of the connection coefficients ("Christoffel symbols"). In conjunction with the associated transformation rules for their
canonical conjugates, this *unambiguously* yields a Hamiltonian that is form-invariant under a general transition to another reference frame. Thereby, a description of the dynamics of space-time is established that is not postulated but *derived from basic principles*, namely the action principle and the general principle of relativity. No further assumptions are incorporated. Neither a torsion of space-time is excluded *a priori*, nor a specific correlation of the Christoffel symbols with the metric is postulated. Moreover, the resulting theory satisfies the principle of scale invariance and is renormalizable.

Remarkably, the corresponding Lagrangian of the presented formalism was already proposed in 1918 by A. Einstein in a personal letter to H. Weyl, reasoning analogies with other classical field theories.

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