

General Relativity and Quantum Cosmology

Gravity in presence of fermions as a SU(2) gauge theory

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The Hamiltonian formulation of the Holst action in presence of a massless fermion field with a non-minimal Lagrangian is performed without any restriction on the local Lorentz frame. It is outlined that the phase space structure does not resemble that one of a background independent Lorentz gauge theory, as some additional constraints are present. Proper phase space coordinates are introduced, such that SU(2) connections can be defined and the vanishing of conjugate momenta to boost variables is predicted. Finally, it is demonstrated that for a particular value of the non-minimal parameter the kinematics coincides with that one of a background independent SU(2) gauge theory and the Immirzi parameter becomes the coupling constant of such an interaction between fermions and the gravitational field.

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