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# Hamiltonian study for Chern-Simons and Pontryagin theories

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The Hamiltonian analysis for the Chern-Simons theory and Pontryagin invariant, which depends of a connection valued in the Lie algebra of SO(3,1), is performed. By applying a pure Dirac's method we find for both theories the extended Hamiltonian, the extended action, the constraint algebra, the gauge transformations and we carry out the counting of degrees of freedom. From the results obtained in the present analysis, we will conclude that the theories under study have a closed relation among its constraints and defines a topological field theory. In addition, we extends the configuration space for the Pontryagin theory and we develop the Hamiltonian analysis for this modified version, finding a best description of the results previously obtained.

**Submission history**

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