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Some features of the Hamiltonian Analysis of Asymptotic Safe Quantum Gravity

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After a brief introduction to the basic ideas underlying Asymptotic Safety, we analize a RG improved Einstein-Hilbert Lagrangian in which the cosmological constant and the gravitational constant are non geometrical fields, functions of the Space-Time and determined by the Renormalization Group. The main goal of this Hamiltonian analysis is to probe the vacuum of Asymptotic Safety. This Hamiltonian theory exibits non trivial Dirac's constraints which, despite Einstein General Relativity, are second class due to the breaking of diff-invariance by $G(x)$ and $\Lambda(x)$. To throw light on this complicated scenario, the parent Brans-Dicke theory is analyzed. Its Dirac's constraint analysis has first class constraints which are not equivalent to Einstein's General Relativity. Its Dirac's constraint algebra, contrary to some claims in the litterature, does not reduce to Einstein General Relativity algebra. In general it is believed that Brans-Dicke theory is equivalent to Einstein General Relativity by passing from the Jordan Frame to the Einstein Frame. We prove this transformation is not canonical and generates two inequivalent Hamiltonian theories and then two inequivalent quantum theories.

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