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On the relation between the canonical Hamilton-Jacobi equation and the De Donder-Weyl Hamilton-Jacobi formulation in general relativity

Monday 23 September 2019 17:10 (20 minutes)

We discuss the relation between the canonical Hamilton-Jacobi theory and the De Donder-Weyl Hamilton-Jacobi theory known in the calculus of variations using the examples of a scalar field on curved space-time background and general relativity.

We show that the canonical Hamilton-Jacobi equation of general relativity which preceded the Wheeler-De Witt formulation of quantum gravity can be derived from the De Donder-Weyl Hamilton-Jacobi reformulation of the Einstein equations. The timelessness of the canonical Hamilton-Jacobi formulation appears as a consequence of the split into space and time in the Donder-Weyl Hamilton-Jacobi equation where no space-time decomposition is required. The result is crucial for the understanding of the relation between various formulations of canonical quantum gravity and the results of precanonical quantization of general relativity based on the De Donder-Weyl Hamiltonian theory.

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