

Motohashi: "Healthy degenerate theories with arbitrary higher-order derivatives"

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Scalar-tensor theories serve models for inflation and dark energy. Many efforts have been made recently for constructing most general scalar-tensor theories with higher-order derivatives in their Lagrangian. Since higher-derivative theories are typically associated with Ostrogradsky ghost which causes unbounded Hamiltonian, it is important to clarify how to evade it. In this talk, I will discuss construction of healthy degenerate theories with higher-order derivatives which circumvent Ostrogradsky ghost. Generalizing the previous works on construction of ghost-free theories with second-order derivatives in Lagrangian, we clarify how to construct healthy theories with arbitrary higher-order derivatives. The necessary and sufficient condition for the absence of ghost degrees of freedom for theories with second-order derivatives is to eliminate linear dependence of canonical momenta in Hamiltonian. We find that this condition is not sufficient for theories with higher-than-second-order derivatives, and that linear dependence of canonical variables are also needed to be removed appropriately. We provide specific examples of healthy higher-order theories as well as ghost-free conditions for general theories with arbitrary higher-order derivatives to remove all the ghost degrees of freedom, under which we show that the Euler-Lagrange equations are reducible to a second-order system.