

Viable Constraints of Scalar-Tensor Theory in the Einstein Frame Formulation

Dr. Ling-Wei Luo (Academia Sinica)

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Abstract: The scalar-tensor theory can be formulated in both Jordan and Einstein frames, which are conformally related together with a redefinition of the scalar field. As the solution to the equation of the scalar field in the Jordan frame does not have the one-to-one correspondence with that in the Einstein frame, we give a criterion along with some specific models to check if the scalar field in the Einstein frame is viable or not by confirming whether this field is reversible back to the Jordan frame. We further show that the criterion in the first parameterized post-Newtonian approximation can be determined by the parameters of the osculating approximation of the coupling function in the Einstein frame and can be treated as a viable constraint on any numerical study in the scalar-tensor scenario. We also demonstrate that the Brans-Dicke theory with an infinite constant parameter ω_{BD} is a counterexample of the equivalence between two conformal frames due to the violation of the viable constraint.