



General Relativity and Quantum Cosmology

On Third Order Lagrangians, Weyl Invariants & Classical Trace Anomaly in Six Dimensions

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We have proceeded the analogy of Einstein tensor and alternative form of Einstein field equations for generic coefficients of eight terms in third order of Lovelock Lagrangian. We have found constraint between the coefficients in two forms, an independent and a dimensional dependent versions. Each form has three degrees of freedom, and not only coefficients of third order Lovelock Lagrangian satisfy the two forms of constraints, but also the two independent cubic of Weyl tensor satisfy the independent constraint in six dimensions and yield the dimensional dependent version identically independent of dimension. Then, we have introduced most general effective expression for a total third order type Lagrangian with homogeneity degree number three consisted of previous eight terms plus new three ones among all seventeen independent terms. We have proceeded the analogy for this combination, and have achieved relevant constraint. We have shown that expressions given in the literature as third Weyl invariant in six dimensions satisfy this constraint. Thus, we suggest that these constraints to be considered as necessary consistency conditions on numerical coefficients that a Weyl invariant should satisfy. Finally, we have calculated the classical trace anomaly (an approach presented in our previous works) for the introduced total third order type Lagrangian as general expression with four degrees of freedom. Then, we have demonstrated that obtained expression contains exactly the relevant coefficient of Schwinger-DeWitt proper time method (that linked with the relevant heat kernel coefficient) in six dimensions, as a particular case. Of course this result is a necessary consistency test, but our approach may be regarded as allowing an alternative classical derivation of trace anomaly that gives a general expression with relevant degrees of freedom.

Comments: 26 pages, appendix and references added

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