Towards the dynamics in Einstein-Gauss-Bonnet gravity: Initial Value Problem

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Towards the investigation of the full dynamics in higher-dimensional and/or stringy gravitational model, we present the basic equations of the Einstein-Gauss-Bonnet gravity theory.

We show (N+1)-dimensional version of the ADM decomposition including Gauss-Bonnet terms, which shall be the standard approach to treat the space-time as a Cauchy problem.

Due to the quasi-linear property of the Gauss-Bonnet gravity, we find that the evolution equations can be in a treatable form in numerics.

We also show the conformally-transformed constraint equations for constructing an initial data.

We discuss how the constraints can be simplified by tuning the powers of conformal factors.

Our equations can be used both for time-like and space-like foliations.

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The Standard ADM Formulation

N+1-dimensional evolution equations

1. Decomposition of the equations, Eqs. (1) and (3) with a choice of gauge condition.

2. Constraints and evolution eqs.

3. Constancy of ADM mass is required for the numerical convergence.

4. Coding is in progress.

Conformal Approach to solve constraints - Eqs. for Initial Data construction

- We generalized the Conformal approach by York and Oberheide (1994) to 8-dim. for Gauss-Bonnet gravity.

- Conformal transformation of the metric

- Conformal transformation of the extrinsic curvature

- When matter exists, define also the conformal transformation

References


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