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Gauss Bonnet Gravity: Singularity Analysis

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Can higher curvature terms in the gravitational action affect the nature of initial-time singularities as well as black hole singularities? Are these singularities traversable? Are these spacetimes extendible? Using Gauss-Bonnet gravity as an example of higher curvature gravity, we try to answer these questions through studying cosmological singularities as well as black hole singularities and the possibility of extending their time like or null geodesics beyond the singular points. We show that in the case of cosmological singularities, the spacetimes are traversable and one can extend the spacetime in such a way to have a geodesically complete manifold. For the case of black hole solutions we show that this extension is not possible for the usual Desert-Boulware black hole in Gauss-Bonnet theory.

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