Nonlinear Dynamics in the Einstein-Gauss-Bonnet gravity

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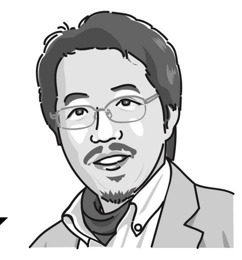

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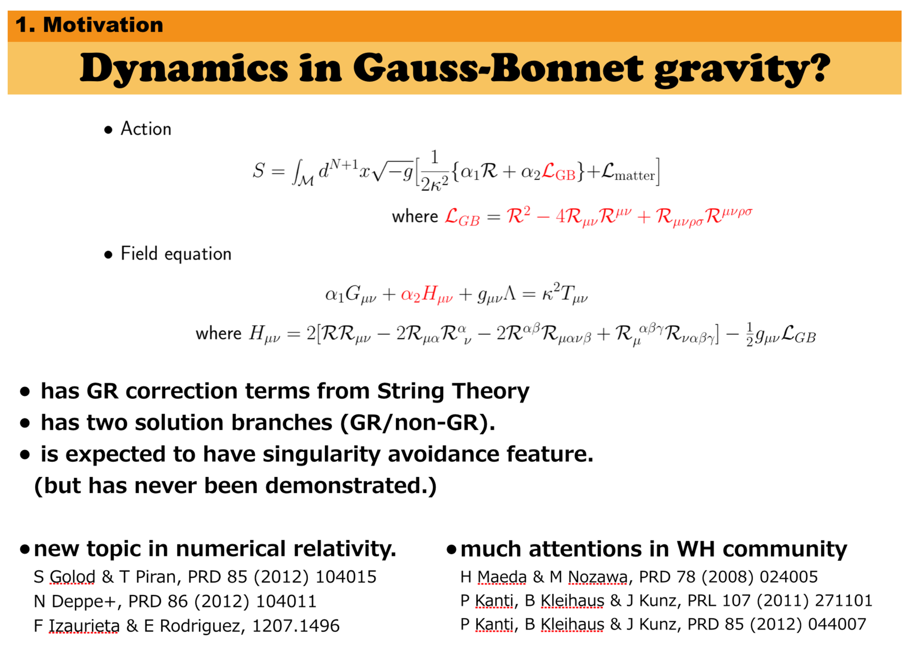
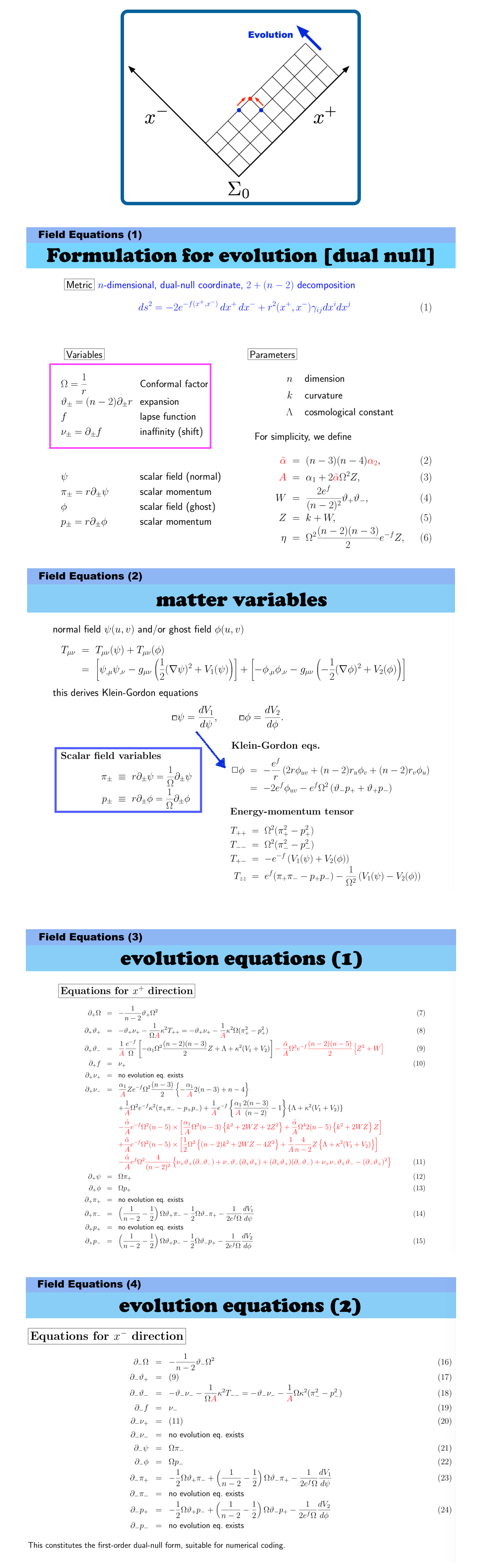


Field Eqs.



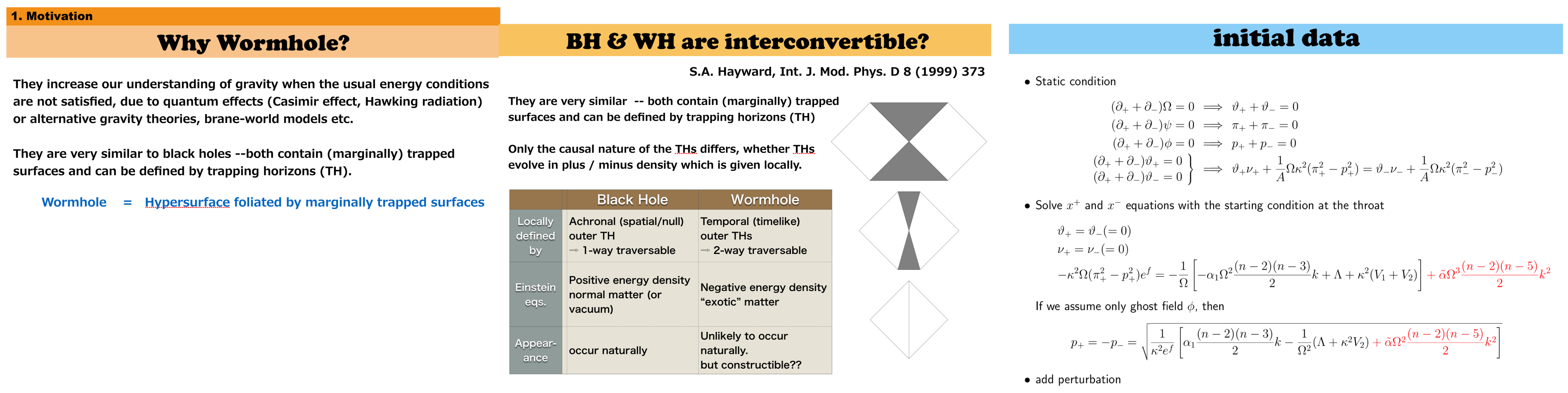
Outline & Summary

We numerically investigated how the dynamics depends on the dimensionality and how the higher-order curvature terms affect to singularity formation in two models: (i) perturbed wormhole in spherically symmetric space-time, and (ii) colliding scalar pulses in planar space-time. Our numerical code uses dual-null formulation, and we compare the dynamics in 5, 6 and 7-dimensional General Relativity and Gauss-Bonnet (GB) gravity.

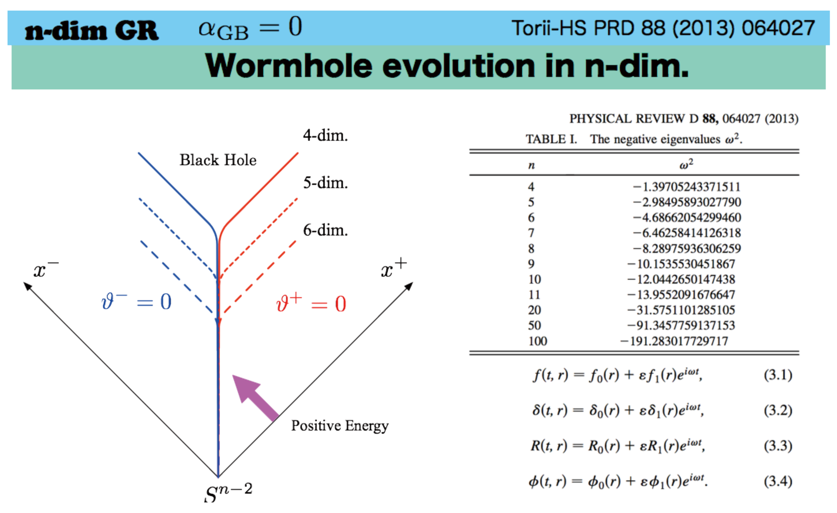
Both results suggest that **GB correction works for avoiding singularity formation in their dynamics**. We also found that **the existence of the trapped surface in GB gravity does not directly indicates formation of BH.**

Wormhole Evolutions

For wormhole dynamics, we observe that the perturbed throat will be easily enhance in the presence of GB term. If we inject large positive energy, then the throat turns to a blackhole, but that threshold of energy becomes larger for larger coupling constant, alpha, and for larger dimensions.

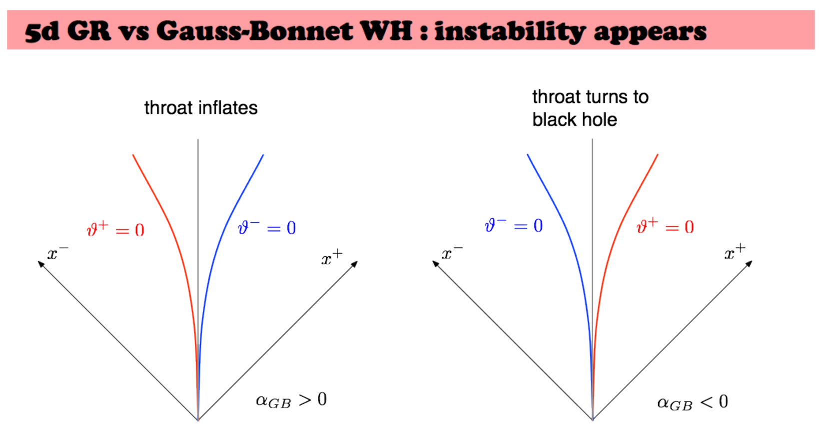


in GR

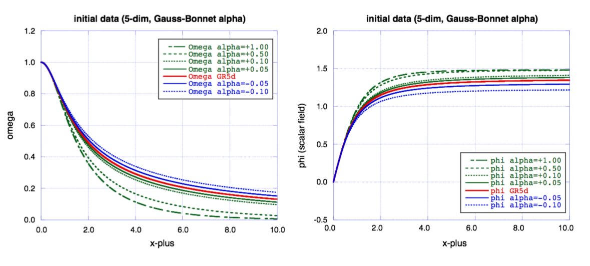


Higher dim -> catch instability earlier

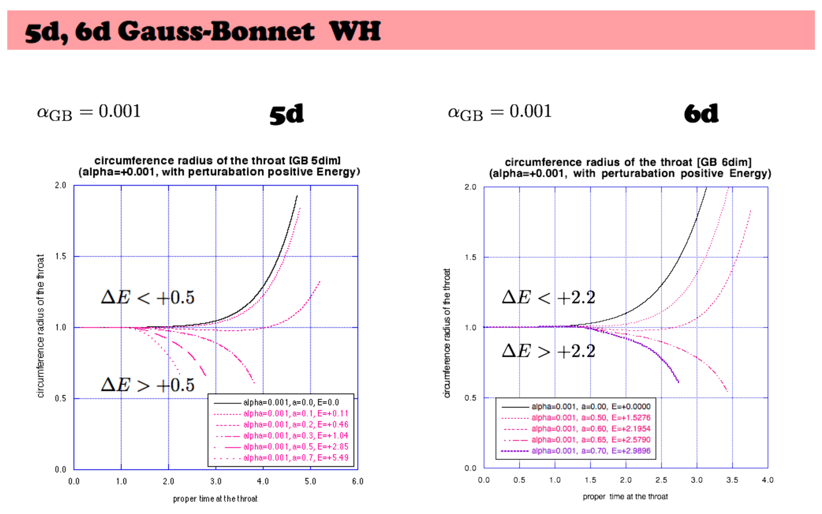
in GB



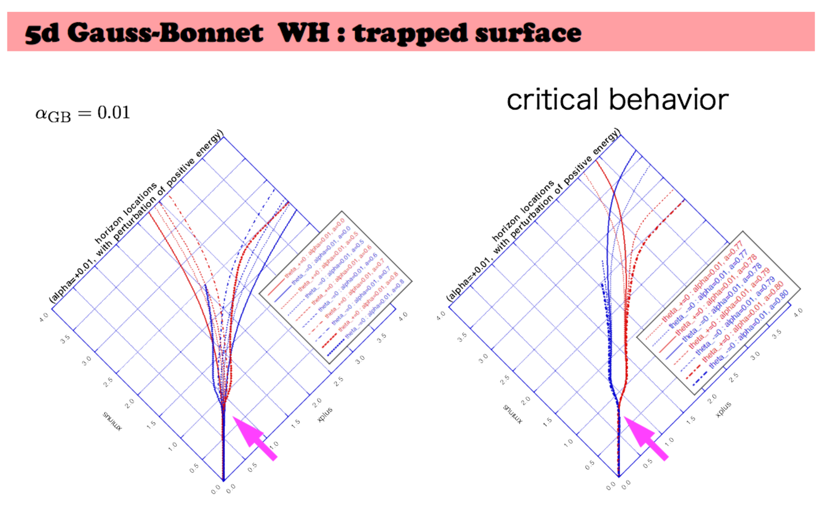
GB terms make wormhole unstable. Final structure depends on the signature of coupling constant, but normal GB prefers not to form a blackhole.



conformal factor   scalar field



need more positive energy for transition to BH in 6dim



existence of trapped surface
—> not necessary to form a BH

Colliding Scalar Waves

For scalar wave collisions, we observe that curvature (Kretschmann invariant) evolves milder in the presence of GB term and/or in higher-dimensional space-time, while the singularity formation is inevitable.