

Ghosts, Instabilities, and Superluminal Propagation in Modified Gravity Models

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with Mark Hindmarsh, Mark Trodden ([hep-th/0604154](https://arxiv.org/abs/hep-th/0604154), JCAP)



Introduction

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 - ★ or non-minimally coupled scalar field?

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- ★ Modify gravity at large scales

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- DGP model [but ghosts issue] [Dvali, Gabadadze, Porrati Phys.Lett.B485 (2000)]
[Koyama PRD 72 123511 (2005)] [Charmousis, Gregory, Kaloper, Padilla hep-th/0604086 (2006)]

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- It leads, in general, to a system of non-linear ODEs of fourth order in the scale factor [Mena, Santiago, Weller PRL 96 (2006)]

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- No spin-2 ghosts for GB combination, $a_2 = -4a_3$

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- ϕ eqn: $\phi = b R^2 + R_{GB}^2$

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- The eqns are 2nd order: no spin-2 ghost! [Nunez, Solganik PLB 608 (2005)][Chiba JCAP 0503 (2005)][Navarro, van Acoleyen gr-qc/0511045]

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- **Not** all backgrounds may be safe

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- Expand the action about general flat FRW!

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- Squared Speed of propagation

$$s = \frac{B(t)}{A(t)}$$

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- Vector modes do not propagate [Hwang, Noh PRD 61 (2000)]

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- Superluminal: No unicity of the future cone, ill-defined Cauchy problem, $B/A > 1$

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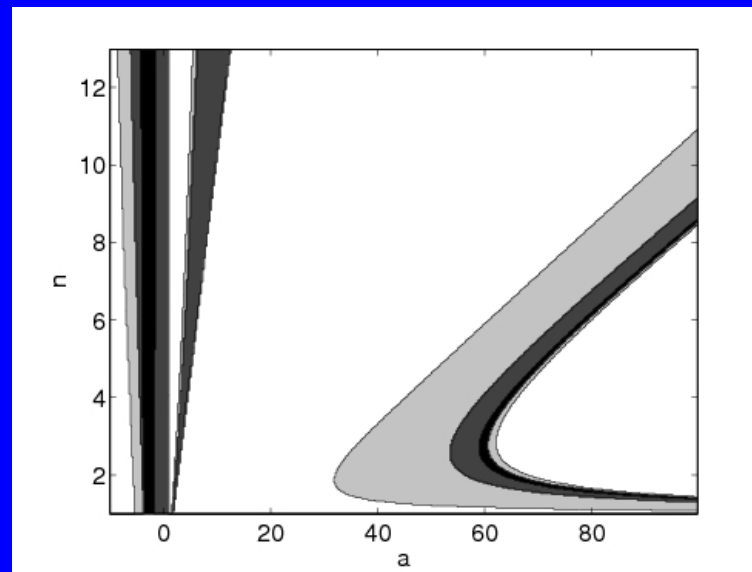
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- Ghosts instabilities, no FRW

Constraints from attractors

- Look for accelerating power-law attractors space



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