

Galileons in Supergravity

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galileons

higher derivative theories with no ghosts

- ▶ flat space-time

$$\mathcal{L}_I = -\partial_m\phi\partial^m\phi + \frac{1}{M_*^3}\partial_m\phi\partial^m\phi\partial^2\phi$$

- ▶ curved space-time: [Horndeski \(1974\)](#)

$$\mathcal{L}_{II} = -\partial_m\phi\partial^m\phi + \frac{1}{M_*^2}E^{mn}\partial_m\phi\partial_n\phi$$

- ▶ gauged galileons: [Copeland, Zhou \(1112.0968\)](#)
- ▶ **supersymmetric?**

superspace

new-minimal supergravity:

- ▶ matter superfield

$$\Phi = A + \sqrt{2}\theta\psi + \theta^2 F$$

- ▶ graviton superfield

$$\phi_m = \theta\sigma^n\bar{\theta}(h_{mn} + B_{mn}) - i\theta^2\bar{\theta}\bar{\psi}_m + i\bar{\theta}^2\theta\psi_m + \frac{1}{2}\theta^2\bar{\theta}^2 A_m$$

- ▶ Einstein superfield

$$E_m = -\frac{1}{2}\epsilon_{mnr s}\bar{D}\bar{\sigma}^n D\partial^r\phi^s = \dots + \theta\sigma^n\bar{\theta}(E_{mn}) + \dots$$

Ceccotti, Ferrara, Porrati, Sabharwal (1987)

non-minimal derivative coupling

- ▶ consider the superspace Lagrangian

$$\mathcal{L}_{II} = \int d^4\theta [\bar{\Phi}\Phi + M_P^2 E^m \phi_m - \frac{2i}{M_*^2} \Phi E^m \partial_m \bar{\Phi}]$$

- ▶ in component form

$$\mathcal{L}_{II} = \frac{M_P^2}{2} R + A \partial^2 \bar{A} + \frac{1}{M_*^2} E^{mn} \partial_m A \partial_n \bar{A} + \text{fermions}$$

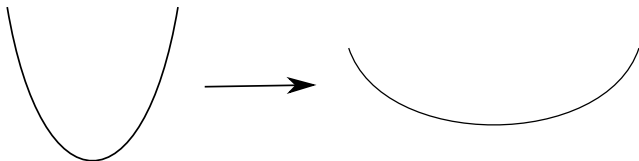
FF, Germani, Kehagias, Saridakis (1202.3780)

- ▶ this is a galileon, it has **no ghosts**

applications

what is it good for?

- ▶ gravitational enhanced friction: during inflation it relaxes slow roll conditions



- ▶ sub-Planckian inflaton values: a supergravity theory is expanded in inverse Plank scale, not a problem any more

FF, Dalianis, Kehagias (work in progress)

outlook

- ▶ constructing galileons in supergravity is not trivial;
which do exist?
- ▶ Here we considered local supersymmetry, do galileons exist in global supersymmetry?

FF, Germani, Kehagias (work in progress)

thank you

Thank you!