Scale symmetry and the nature of gravity

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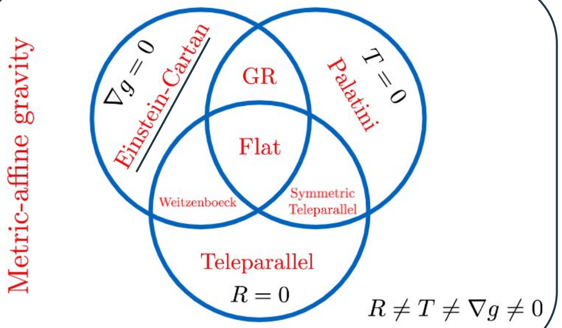
Testing the nature of gravity



Different formulations yield the same theory, unless… we introduce some new ingredient

Non-minimal coupling: $$\frac{\xi h^2}{2} R$$

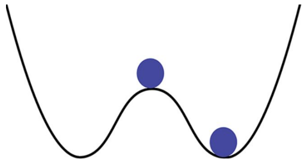
Higgs + Non-minimal coupling = Inflation

<u>WE CAN CONSTRAIN THE MODEL</u>

The role of scale symmetry

$$\begin{cases} g_{\mu\nu}(x) \mapsto g_{\mu\nu}(\sigma x) \\ \Phi(x) \mapsto \sigma^{d_\Phi}\Phi(\sigma x) \end{cases}$$

Spontaneously broken symmetry



Motivations

- Protect the Higgs mass from large radiative corrections
- All the scales in the model have a common origin
- The SM+gravity is approximately scale invariant during inflation

Consequences

- 1 extra scalar degree of freedom: **DILATON**
- 6 free parameters

Work-plan

$$S = \frac{1}{2}\int \mathrm{d}^4x\sqrt{-g}\left[\left(\tau\chi^2+\xi h^2\right)R + \frac{1}{2\bar{\gamma}}\left(\tau\chi^2+\xi_\gamma h^2\right)\epsilon^{\mu\nu\rho\sigma}R_{\mu\nu\rho\sigma}\right] + \frac{1}{2}\int \mathrm{d}^4x\left(\tau_\eta\chi^2+\xi_\eta h^2\right)\partial_\mu\left(\sqrt{-g}\epsilon^{\mu\nu\rho\sigma}T_{\nu\rho\sigma}\right)$$

Holst term

Nieh-Yan term

Objectives for my PhD

- Compute the inflationary observables and compare them with the data
- Establish the validity range of the theory
- Study the connection of inflationary physics to low-energy observables
- Determine the ability to restrict the abundance of primordial black holes
- Perform a detailed treatment of the reheating stage

Thanks for your attention