Mémoire

Auteur : Tribolet, Augustin
Promoteur(s) : 23983; Cudell, Jean-René
Faculté : Faculté des Sciences
Diplôme : Master en sciences spatiales, à finalité approfondie
Année académique : 2023-2024
URI/URL : http://hdl.handle.net/2268.2/19935

Erratum for
Modified Gravity Theories and the Amplification of Inflationary Perturbations

Augustin Tribolet

June 28, 2024

Introduction

This document lists corrections for errors found in the original submission of my thesis titled *Modified Gravity Theories and the Amplification of Inflationary Perturbations* submitted on June 3, 2024.

List of Corrections

- **Page 11, Eq. (23):**
  - Original text:
  $$S = S_E + S_\phi = \frac{\mathrm{M_P^2}}{2}\int d^4x\sqrt{-g}R + \int d^4x\sqrt{-g}\left[-\frac{1}{2}g^{\mu\nu}\partial_\mu\phi\partial_\nu\phi - V(\phi)\right]$$
  - Corrected text:
  $$S = S_E + S_\phi = \frac{\mathrm{M_P^2}}{2}\int d^4x\sqrt{-g}R + \int d^4x\sqrt{-g}\left[-\frac{1}{2}g^{\mu\nu}\partial_\mu\phi\partial_\nu\phi + V(\phi)\right]$$
- **Page 12, Footnote 6:**
  - Original text: $ds^2 = -dt^2 + e^{2Ht}d\vec{x}^2$
  - Corrected text: $ds^2 = dt^2 - e^{2Ht}d\vec{x}^2$
- **Page 15, Section 1.3.2:**
  - Original text: In the literature, it is usually assumed that the inflaton field evolves towards a de Sitter attractor.
  - Corrected text: In the literature, it is usually assumed that the inflaton field evolves towards SR inflation, i.e. a quasi-de Sitter attractor.
- **Page 17, Section 1.3.3:**
  - Original text: In SR inflation, we had $w < -1/3$, while in USR we have $w \to -1$ as it can be seen from Eq. (28) taking $\dot{\phi}^2 \ll V(\phi)$.

- Corrected text: In SR inflation, we had $w \ll 1$, while in USR we have $w \to -1$ extremely rapidly, as can be seen from Eq. (28) taking $\dot{\phi}^2 \ll V(\phi)$.

- **Page 21, Figure 4:**
  - Original text: Evolution of perturbations during the inflation and the Hot Big Bang. Each mode enters the super-horizon regime because of inflation. During this phase, perturbations are causally connected.
  - Corrected text: Evolution of perturbations during the inflation and the Hot Big Bang. Each mode enters the super-horizon regime because of inflation. In the sub-horizon regime, perturbations are causally connected.

- **Page 33, Section 3:**
  - Original text: where G is the gravitational constant, M is the mass of the black hole, and c is the speed of light.
  - Original text: where G is the gravitational constant, M_{BH} is the mass of the black hole, and c is the speed of light.

- **Page 36, Section 3.1.1:**
  - Original text:

$$\Delta N_{\rm form} = \ln\left(\frac{10}{H_{k=aH}}\right)^{1/2} - \ln\left(\frac{10}{H_{k=aH}}\right) \approx 1.$$

  - Corrected text:

$$\Delta N_{\rm form} = \ln\left(\frac{10}{H_{k=aH}}\right)^{1/2} - \ln\left(\frac{1}{H_{k=aH}}\right)^{1/2} \approx 1.$$

- **Page 37, Section 3.1.3:**
  - Original text: The density contrast δ represents the fluctuation in density w.r.t. to the average density of the universe.
  - Corrected text: The density contrast δ represents the fluctuation in density w.r.t. the average density of the universe.

- **Page 42, Section 3.3.1:**
  - Original text: Therefore, close to the USR attractor, we can also use the same results.
  - Corrected text: Therefore, close to the USR or CR attractor, we can also use the same results.

- **Page 47, Section 4:**
  - Original text: During the CR and USR phases, the scalar field evolves towards a quasi-de Sitter attractor and a de Sitter attractor solution, respectively.
  - Corrected text: During the SR and USR (or CR) phases, the scalar fields evolve towards a quasi-de Sitter attractor and a de Sitter attractor solution, respectively.

- **Page 59, Eq. (168)**
  - Original text: $\gamma < 3$
  - Corrected text: $0 < \gamma < 3$
- **Page 75, Section 6:**
  - Original text: The important point is that the action (225) is defined on the spacetime as the original action (224).
  - Corrected text: The important point is that the action (225) is defined on the same spacetime as the original action (224).
- **Page 77, Section 6:**
  - Original text: which combined gives finally the analytical expression of the function $f(R)$, see:
  - Corrected text: which combined gives finally the analytical expression of the function $f(R)$:
- **Page 84, Section 6.2.2:**
  - Original text: The solutions are stable provided that $0 < n < 2$, using Eq. (258).
  - Corrected text: The solutions are stable provided that $0 < n < 2$, using Eq. (258), which corresponds to $\beta < 0$.
- **Page 85, Section 6.2.4:**
  - Original text:

    $$n_F(R_0) = \frac{1 + \frac{M^2 n(n-1)}{2R_0\alpha(n-2)}}{1 + \frac{M^2(n-1)}{2R_0\alpha(n-2)}} \equiv \frac{1+n\nu}{1+\nu} \quad \text{where} \quad \nu = \frac{M^2(n-1)}{2R_0\alpha(n-2)}.$$

    In the case $n > 1$, the stability condition is respected if $-1/n < \nu < 0$ and $\nu < -1$. While the case $n < 2$ requires $\nu > 0$ to have a stable solution.
  - Corrected text:

    $$n_F(R_0) = \frac{1 + \frac{M^2 n(n-1)}{2R_0\alpha(n-2)}}{1 + \frac{M^2(n-1)}{R_0\alpha(n-2)}} \equiv \frac{1+\frac{n}{2}\nu}{1+\nu} \quad \text{where} \quad \nu = \frac{M^2(n-1)}{R_0\alpha(n-2)}.$$

    In the case $n > 2$, the stability condition is respected if $-2/n < \nu < 0$. The cases $0 < n < 1$ and $1 < n < 2$ require $\nu > 0$ or $\nu < -2/n$ to have a stable solution. Finally, when $n < 0$, the stability condition requires $0 < \nu < -2/n$.