Loop Blow-up Inflation

Sukṛti Bansal

Technical University of Vienna, Austria

Based on arXiv:2403.04831
with L. Brunelli, M. Cicoli, A. Hebecker & R. Kuespert

2025 Workshop on Quantum Gravity and Strings,
Corfu Summer Institute, Greece

12th Sep' 2025

Introduction

Kähler moduli inflation: a model of inflation in the Large Volume Scenario (LVS) for moduli stabilisation of type IIB flux compactifications [Conlon, Quevedo '05]

Introduction

Kähler moduli inflation: a model of inflation in the Large Volume Scenario (LVS) for moduli stabilisation of type IIB flux compactifications [Conlon, Quevedo '05]

Inflationary models based on moduli stabilisation

Can moduli stabilisation allow slow-roll conditions to be met?

Introduction

Kähler moduli inflation: a model of inflation in the Large Volume Scenario (LVS) for moduli stabilisation of type IIB flux compactifications [Conlon, Quevedo '05]

Inflationary models based on moduli stabilisation

Can moduli stabilisation allow slow-roll conditions to be met?

Kähler moduli: ideal candidates for inflaton

Volume modulus: lightest modulus

Introduction

Kähler moduli inflation: a model of inflation in the Large Volume Scenario (LVS) for moduli stabilisation of type IIB flux compactifications [Conlon, Quevedo ’05]

Inflationary models based on moduli stabilisation

Can moduli stabilisation allow slow-roll conditions to be met?

Kähler moduli: ideal candidates for inflaton

Volume modulus: lightest modulus

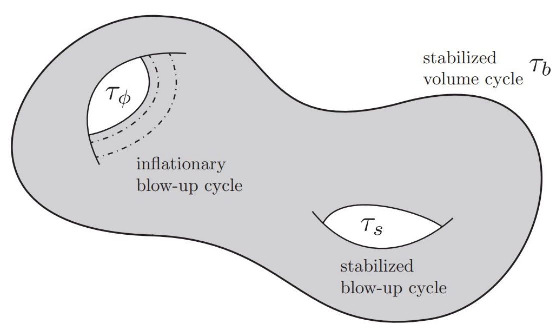
All moduli orthogonal to the overall volume obey approximate shift symmetry

$\Rightarrow$ volume modulus can be stabilized at a sufficiently large value

Kähler moduli of type IIB flux compactifications

We consider a minimalistic model with 3 Kähler moduli.

Kähler moduli: $T_i = \tau_i + i\, c_i \ , \quad i \in \{b,\, \phi\,, s\}$

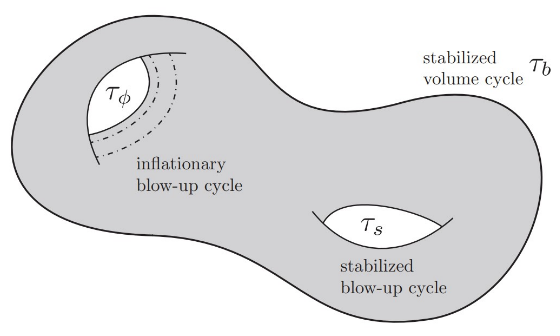


Kähler moduli of type IIB flux compactifications

We consider a minimalistic model with 3 Kähler moduli.

Kähler moduli: $T_i = \tau_i + i\, c_i \,, \quad i \in \{b,\, \phi\,, s\}$

$$\mathcal{V} \;=\; \tau_b^{3/2} - \lambda_\phi \tau_\phi^{3/2} - \lambda_s \tau_s^{3/2} \,, \quad \tau_b \gg \tau_\phi \gg \tau_s$$



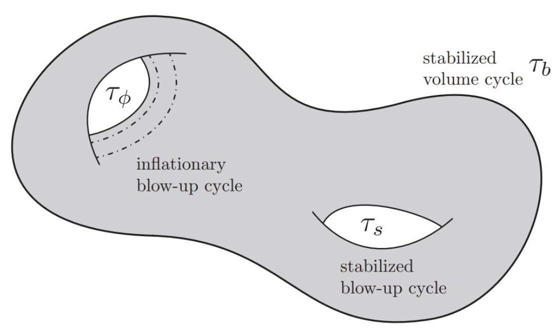
Kähler moduli of type IIB flux compactifications

We consider a minimalistic model with 3 Kähler moduli.

<u>Kähler moduli</u>: $T_i = \tau_i + i\, c_i\,, \quad i \in \{b,\, \phi\,, s\}$

$$\mathcal{V} \;=\; \tau_b^{3/2} - \lambda_\phi \tau_\phi^{3/2} - \lambda_s \tau_s^{3/2}\,, \quad \tau_b \gg \tau_\phi \gg \tau_s$$

τ_ϕ and τ_s are the blow-up modes



Kähler moduli of type IIB flux compactifications

N=1 supergravity

Superpotential: $W = W_0 + \underbrace{A_s\, e^{-a_s T_s} + A_\phi\, e^{-a_\phi T_\phi}}_{\text{non-pert corrections}}$

Kähler potential: $K = K_{\mathrm{cs}} - 2\ln(\mathcal{V}) - \underbrace{2\ln(\hat{\xi}/2)}_{\alpha'^3 \text{ correction}}$

F-term scalar potential: $V_F = e^K \left(K^{I\bar{J}} D_I W \overline{D_J W} - 3|W|^2 \right)$,

where $D_I W = \partial_I W + (\partial_I K) W$ and $K_{I\bar{J}} = \partial_I \partial_{\bar{J}} K$.

Has the *no-scale* structure [Giddings, Kachru, Polchinski ’02].

Large Volume Scenario

In the regime $\mathcal{V} \gg 1$ and $\tau_b \gg \tau_i$ (for $i = s, \phi$)

$$V_{\text{LVS}} = \hat{V} \left[\sum_{i=s,\phi} \mathcal{A}_i \, \frac{\sqrt{\tau_i}\, e^{-2a_i\tau_i}}{\mathcal{V}} - \sum_{i=s,\phi} \mathcal{B}_s \, \frac{\tau_i\, e^{-a_i\tau_i}}{\mathcal{V}^2} + \frac{3\hat{\xi}}{4\mathcal{V}^3} \right]$$

where

$$\hat{V} \equiv \left(\frac{g_s e^{K_{cs}}}{8\pi} \right) W_0^2 \,, \qquad \mathcal{A}_i \equiv \frac{8\,(a_i A_i)^2}{3 W_0^2 \lambda_i} \,, \qquad \mathcal{B}_i \equiv 4 \frac{a_i |A_i|}{W_0}$$

Large volume limit: On minimising the above potential w.r.t. τ_s it can be seen that as $\mathcal{V} \to \infty$, $a_s\tau_s \approx \ln \mathcal{V}$.

Large Volume Scenario

In the regime $\mathcal{V} \gg 1$ and $\tau_b \gg \tau_i$ (for $i = s, \phi$)

$$V_{\text{LVS}} = \hat{V} \left[\sum_{i=s,\phi} \mathcal{A}_i \, \frac{\sqrt{\tau_i}\, e^{-2a_i\tau_i}}{\mathcal{V}} - \sum_{i=s,\phi} \mathcal{B}_s \, \frac{\tau_i \, e^{-a_i\tau_i}}{\mathcal{V}^2} + \frac{3\hat{\xi}}{4\mathcal{V}^3} \right]$$

where

$$\hat{V} \equiv \left(\frac{g_s e^{K_{cs}}}{8\pi} \right) W_0^2 \, , \qquad \mathcal{A}_i \equiv \frac{8\,(a_i A_i)^2}{3 W_0^2 \lambda_i} \, , \qquad \mathcal{B}_i \equiv 4 \frac{a_i |A_i|}{W_0}$$

Large volume limit: On minimising the above potential w.r.t. τ_s it can be seen that as $\mathcal{V} \to \infty$, $a_s\tau_s \approx \ln \mathcal{V}$.

Uplift AdS minimum to Minkowski: $V_{\text{up}}(\mathcal{V}) = \dfrac{\hat{V}\mathcal{D}}{\mathcal{V}^2}$

$V_{\text{np}} = V_{LVS} + V_{\text{up}}$

Large Volume Scenario

Uplift AdS minimum to Minkowski: $V_{\mathrm{up}}(\mathcal{V}) = \frac{\hat{V}\mathcal{D}}{\mathcal{V}^2}$

$$V_{\mathrm{np}} = V_{LVS} + V_{\mathrm{up}}$$

Feasibility of anti-D3-brane uplift has been challenged [Junghans '22] [Gao, Hebecker, Schreyer, Venken '22 - '24]. It won't work but it's not required either.

Alternative uplift mechanisms:

- D-term effects [Braun, Rummel, Sumitomo, Valandro '15]
- dilaton-dependent non-perturbative contributions [Cicoli, Maharana, Quevedo, Burgess '12] [Retolaza, Uranga '16]
- T-branes [Cicoli, Quevedo, Valandro '16]
- non-zero F-terms of the complex structure moduli [Gallego, Marsh, Vercnocke, Wrase '17] [Hebecker, Leonhardt '21] [Krippendorf, Schachner '23]

Until the introduction of loop blow-up inflation

Original blow-up inflation [Conlon, Quevedo '06]

Up until this work, it was believed that *string loop corrections*

Problem:

destroy this non-perturbative slow-roll inflationary model

Until the introduction of loop blow-up inflation

Original blow-up inflation [Conlon, Quevedo '06]

Up until this work, it was believed that *string loop corrections*

Problem:

destroy this non-perturbative slow-roll inflationary model

Ways to circumvent the problem:

- do not exist if there are no branes wrapping the del Pezzo divisors
- if present, can be made negligible by tuning g_s and $\mathcal{W}$ to be appropriately small

Inevitability of loop corrections

What we found out about the speculations – *string loop corrections*:

Does the problem really exist?

destroy this non-perturbative slow-roll inflationary model?

- true only if the coefficient of the loop corrections $\gtrsim \mathcal{O}(10^{-6}) \Rightarrow$ seems no

Inevitability of loop corrections

What we found out about the speculations – *string loop corrections*:

Does the problem really exist?

destroy this non-perturbative slow-roll inflationary model?

- true only if the coefficient of the loop corrections $\gtrsim \mathcal{O}(10^{-6}) \Rightarrow$ seems no
- [Gao, Hebecker, Schreyer, Venken '22] estimate $c_{\text{loop}} \sim (2\pi)^{-4} \sim 10^{-4}$,

  4D EFT logic $c_{\text{loop}} \sim 1/(16\pi^2) \Rightarrow$ actually yes :-(

Inevitability of loop corrections

What we found out about the speculations – *string loop corrections*:

Does the problem really exist?

destroy this non-perturbative slow-roll inflationary model?

- true only if the coefficient of the loop corrections $\gtrsim \mathcal{O}(10^{-6})$ ⇒ seems no
- [Gao, Hebecker, Schreyer, Venken '22] estimate $c_{\text{loop}} \sim (2\pi)^{-4} \sim 10^{-4}$,

  4D EFT logic $c_{\text{loop}} \sim 1/(16\pi^2)$ ⇒ actually yes :-(

Do the circumventions work?

- do not exist if there are no branes wrapping the del Pezzo divisors?
  - true only for open string loops, closed string loops are inevitable ⇒ no

Inevitability of loop corrections

What we found out about the speculations – *string loop corrections*:

Does the problem really exist?

destroy this non-perturbative slow-roll inflationary model?

- true only if the coefficient of the loop corrections $\gtrsim \mathcal{O}(10^{-6})$ $\Rightarrow$ seems no
- [Gao, Hebecker, Schreyer, Venken '22] estimate $c_{\text{loop}} \sim (2\pi)^{-4} \sim 10^{-4}$,

  4D EFT logic $c_{\text{loop}} \sim 1/(16\pi^2)$ $\Rightarrow$ actually yes :-(

Do the circumventions work?

- do not exist if there are no branes wrapping the del Pezzo divisors?
  - true only for open string loops, closed string loops are inevitable $\Rightarrow$ no
- if present, can be made negligible by tuning g_s and W to be appropriately small?
  - LVS constrains tuning, disallowing neglecting loop corrections $\Rightarrow$ no

Inevitability of loop corrections

What we found out about the speculations – *string loop corrections*:

Does the problem really exist?

destroy this non-perturbative slow-roll inflationary model?

- true only if the coefficient of the loop corrections $\gtrsim \mathcal{O}(10^{-6}) \Rightarrow$ seems no
- [Gao, Hebecker, Schreyer, Venken '22] estimate $c_{\text{loop}} \sim (2\pi)^{-4} \sim 10^{-4}$,

  4D EFT logic $c_{\text{loop}} \sim 1/(16\pi^2) \Rightarrow$ actually yes :-(

Do the circumventions work?

- do not exist if there are no branes wrapping the del Pezzo divisors?
  - true only for open string loops, closed string loops are inevitable $\Rightarrow$ no
- if present, can be made negligible by tuning g_s and W to be appropriately small?
  - LVS constrains tuning, disallowing neglecting loop corrections $\Rightarrow$ no

➤ *String loop corrections are inevitable in blow-up inflation.*

➤ *Estimated values of c_{loop} destroy non-perturbative blow-up inflation.*

String Loop Corrections

String loop correction for Kähler potential

$$\delta K_{(g_s)} = \delta K^{KK}_{(g_s)} + \delta K^{W}_{(g_s)}$$

where [Berg, Haack, Pajer ’07],

$$\delta K^{KK}_{(g_s)} \simeq \sum_i C_i^{KK} \frac{g_s \mathcal{T}^i(t^a)}{\mathcal{V}} \quad , \qquad\qquad \delta K^{W}_{(g_s)} \simeq \sum_i C_i^{W} \frac{1}{\mathcal{I}^i(t^a)\mathcal{V}} \, .$$

String Loop Corrections

String loop correction for Kähler potential

$$\delta K_{(g_s)} = \delta K^{KK}_{(g_s)} + \delta K^{W}_{(g_s)}$$

where [Berg, Haack, Pajer '07],

$$\delta K^{KK}_{(g_s)} \simeq \sum_i C_i^{KK} \frac{g_s \mathcal{T}^i(t^a)}{\mathcal{V}} \quad , \qquad \delta K^{W}_{(g_s)} \simeq \sum_i C_i^{W} \frac{1}{\mathcal{I}^i(t^a)\mathcal{V}} \, .$$

Consequent loop correction for scalar potential

$$\delta V_{\text{loop}} \simeq -\frac{\hat{V}}{\mathcal{V}^3} \frac{c_{\text{loop}}}{\mathcal{V}^{1/3}} f\left(\frac{\mathcal{V}^{2/3}}{\tau_\phi}\right) , \quad c_{\text{loop}} \simeq \begin{cases} C_i^W \\ (g_s C_i^{KK})^2 \end{cases} .$$

f encodes information from the unknown functions $\mathcal{T}^i$ and $\mathcal{I}^i$.

$\delta V^{KK}_{\text{loop}}$ has an 'extended no-scale structure'.

String Loop Corrections

As estimated by [Cicoli, Conlon, Quevedo '08] for open string loops and as derived in [Gao, Hebecker, Schreyer, Venken '22] for closed string loops,

$$f \simeq \frac{\mathcal{V}^{1/3}}{\sqrt{\tau_\phi}} \qquad \text{and hence} \qquad \delta V_{\text{loop}} \simeq -\frac{\hat{V}}{\mathcal{V}^3}\,\frac{c_{\text{loop}}}{\sqrt{\tau_\phi}}\,.$$

$$V = V_{LVS} + V_{\text{up}} + \delta V_{\text{loop}}$$

Inflationary potential

$$V = V_{LVS} + V_{\rm up} + \delta V_{\rm loop}$$

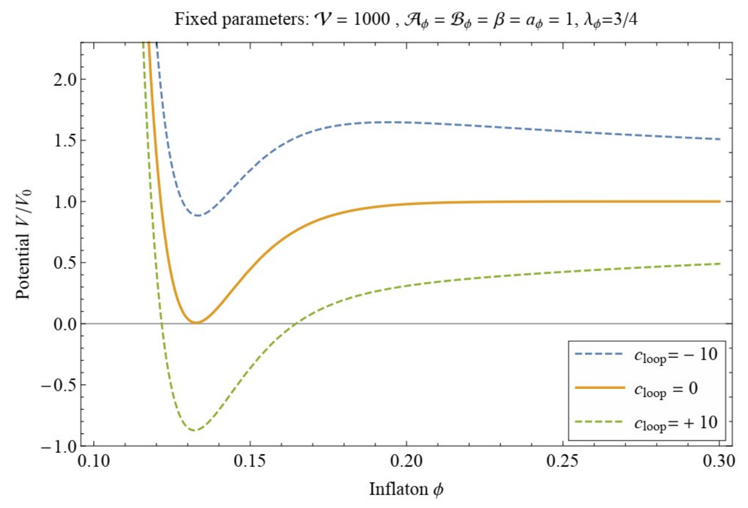
Large volume limit: $\mathcal{V} \to \infty$, $a_s \tau_s \approx \ln \mathcal{V}$.

Stabilising $\mathcal{V}$ and τ_s, we get

$$V(\tau_\phi) = \frac{\hat{V}\beta}{\mathcal{V}^3}\left[1 + \mathcal{A}_\phi \frac{\mathcal{V}^2}{\beta}\sqrt{\tau_\phi}\, e^{-2a_\phi \tau_\phi} - \mathcal{B}_\phi \frac{\mathcal{V}}{\beta}\,\tau_\phi\, e^{-a_\phi \tau_\phi} - \frac{c_{\rm loop}}{\beta\sqrt{\tau_\phi}}\right]$$

Canonically normalised inflaton $\phi = \sqrt{\dfrac{4\lambda_\phi}{3\mathcal{V}}}\,\tau_\phi^{3/4}$

c_{loop} dynamics



$c_{\text{loop}} > 0$ is necessary for slow-roll inflation.

Inflationary dynamics

For $c_{\rm loop} \gtrsim 10^{-6}$ the potential in the inflationary region, where the exponential terms can be neglected, is

$$V(\phi) = V_0 \left(1 - \frac{b\, c_{\rm loop}}{\phi^{2/3}}\right) \qquad \text{where} \qquad b \equiv \frac{1}{\beta}\left(\frac{4\lambda_\phi}{3\mathcal{V}}\right)^{1/3}$$

Another necessary condition: $\phi \lesssim 1$ since $\phi \sim 1 \Rightarrow \tau_\phi \sim \tau_b$.

Inflationary dynamics

For $c_{\rm loop} \gtrsim 10^{-6}$ the potential in the inflationary region, where the exponential terms can be neglected, is

$$V(\phi) = V_0 \left(1 - \frac{b\, c_{\rm loop}}{\phi^{2/3}}\right) \qquad \text{where} \qquad b \equiv \frac{1}{\beta} \left(\frac{4\lambda_\phi}{3\mathcal{V}}\right)^{1/3}$$

Another necessary condition: $\phi \lesssim 1$ since $\phi \sim 1 \Rightarrow \tau_\phi \sim \tau_b$.

Slow roll parameters

$$\epsilon = \frac{1}{2}\left(\frac{V_\phi}{V}\right)^2 \simeq \frac{2}{9}\,\frac{(b\, c_{\rm loop})^2}{\phi^{10/3}}\,, \qquad \eta = \frac{V_{\phi\phi}}{V} \simeq -\frac{10}{9}\,\frac{b\, c_{\rm loop}}{\phi^{8/3}}\,.$$

Small values of $(b\, c_{\rm loop})$ allow slow-roll inflation.

Inflationary dynamics

$$\left.\begin{aligned} N_e &= \int_{\phi_{end}}^{\phi_*} \frac{V}{V_\phi}\,\mathrm{d}\phi \;\simeq\; \frac{9}{16}\,\frac{\phi_*^{8/3}}{b\,c_{\mathrm{loop}}} \\ \hat{A}_s &= \frac{9\,V_0}{4}\,\frac{\phi_*^{10/3}}{(b\,c_{\mathrm{loop}})^2} \;\simeq\; 2.5\times 10^{-7} \end{aligned}\right\} \begin{aligned} \phi_* &= 0.06\,N_e^{7/22} \;\sim\; \mathcal{O}(0.2) \\ \mathcal{V} &= 1743\,N_e^{5/11} \;\sim\; \mathcal{O}(10^4) \end{aligned}$$

ϕ_* and $\mathcal{V}$ satisfy LVS requirements.

$$\begin{aligned} n_s &= 1 + 2\,\eta - 6\,\epsilon \simeq 1 - \frac{20}{9}\,\frac{b\,c_{\mathrm{loop}}}{\phi_*^{8/3}} &&\Rightarrow\; n_s \simeq 1 - \frac{1.25}{N_e}\,, \\ r &= 16\,\epsilon \simeq \frac{32}{9}\,\frac{(b\,c_{\mathrm{loop}})^2}{\phi_*^{10/3}} &&\Rightarrow\; r \simeq \frac{0.004}{N_e^{15/11}}\,. \end{aligned}$$

$$\boxed{r \simeq 0.003(1-n_s)^{15/11}}$$

Moduli Decay and Dark Radiation

Moduli relevant for decay: inflaton and volume modulus

Their decay, besides producing SM particles, yields very light axions which are relativistic and can contribute to extra dark radiation [Cicoli, Conlon, Quevedo '13] [Higaki, Takahashi '12] [Cicoli, Hebecker, Jaeckel and M. Wittner '22].

It is parameterized by ΔN_{eff}.

Inflationary Parameters

Based on post-inflationary study,

$$N_e \simeq 57 + \frac{1}{4}\ln r - \frac{1}{4}\left(N_\phi + N_\chi\right)$$

Different scenarios of post-inflationary evolution:

- SM on D7-branes
    - I) Inflaton-cycle wrapped by D7s: $\Delta N_{\text{eff}} \simeq 0$
    - II) Inflaton-cycle *not* wrapped by D7s: $\Delta N_{\text{eff}} \simeq 0.14$
- SM on D3-branes

$$\left.\begin{array}{ll}\text{III a)} & \text{Inflaton-cycle wrapped by D7s} \\ \text{III b)} & \text{Inflaton-cycle } \textit{not} \text{ wrapped by D7s}\end{array}\right\} \Delta N_{\text{eff}} \simeq 0.36$$

Cosmological Predictions

$$\text{CMB data}: \; n_s = 0.967 \pm 0.004 \quad \text{at } 1\sigma \quad \text{for} \quad \Delta N_{eff} = 0\,.$$

$$\text{Scenario I}: \; n_s = 0.975 \quad \Rightarrow \text{compatible with observations at } 2.5\sigma\,.$$

Better agreement could be achieved by including subleading perturbative corrections or higher α' effects.

$$\text{CMB data}: \; n_s = 0.983 \pm 0.006 \quad \text{at } 1\sigma \quad \text{for} \quad \Delta N_{eff} = 0.39\,.$$

$$\text{Scenario III}: \; n_s = 0.976 \quad \Rightarrow \text{compatible with observations at } 1.2\sigma\,.$$

Cosmological Predictions

$$\text{CMB data}: \; n_s = 0.967 \pm 0.004 \quad \text{at } 1\sigma \quad \text{for} \quad \Delta N_{\mathrm{eff}} = 0\,.$$

$$\text{Scenario I}: \; n_s = 0.975 \qquad \Rightarrow \text{compatible with observations at } 2.5\sigma\,.$$

Better agreement could be achieved by including subleading perturbative corrections or higher α' effects.

$$\text{CMB data}: \; n_s = 0.983 \pm 0.006 \quad \text{at } 1\sigma \quad \text{for} \quad \Delta N_{\mathrm{eff}} = 0.39\,.$$

$$\text{Scenario III}: \; n_s = 0.976 \qquad \Rightarrow \text{compatible with observations at } 1.2\sigma\,.$$

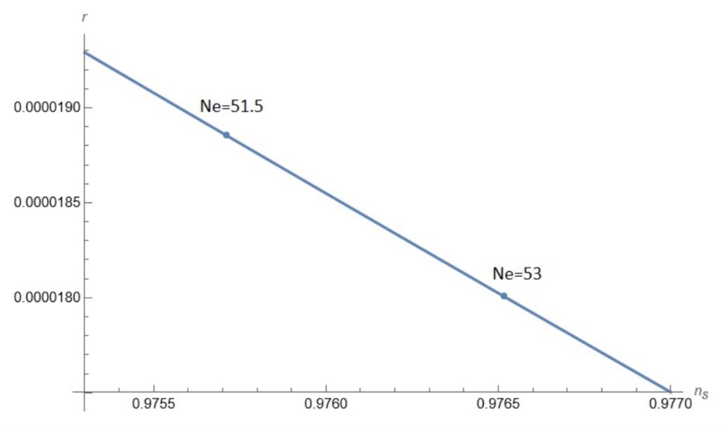
Scenario II is a middle ground b/w scenarios I and III.

Extending existing results of base-ΛCDM model, it can be seen that the predictions for n_s and ΔN_{eff} in scenario II agree with it within around 2σ.

We conclude that the n_s predicted by Loop Blow-Up Inflation is in *good agreement with CMB data*.

Cosmological Predictions

$$\boxed{r \simeq 0.003(1-n_s)^{15/11}}$$



for $51.5 \lesssim N_e \lesssim 53$ $\quad$ n_s in agreement with CMB data $\quad$ $\boxed{r \simeq 2 \times 10^{-5}}$

$\uparrow$

determined by post-inflationary evolution

Subleading Loop Corrections

$$f \simeq \frac{\mathcal{V}^{1/3}}{\sqrt{\tau_\phi}} \left(1 + \frac{\sqrt{\tau_\phi}}{\mathcal{V}^{1/3}} + \frac{\tau_\phi}{\mathcal{V}^{2/3}} + \dots \right) .$$

The additional terms in f modify the potential as follows:

$$V = V_0 \left(1 - c_{\rm loop}\, b \left[\frac{1}{\phi^{2/3}} + \mathfrak{a} + \mathfrak{b}\, \phi^{2/3} + \dots \right]\right) .$$

$\mathfrak{a}, \mathfrak{b} \sim \mathcal{O}(1)$

$$N_e \simeq \frac{9}{16} \frac{\phi_*^{8/3}}{b\, c_{\rm loop}} (1 + 2\, \mathfrak{b}\, \phi_*^{4/3}) .$$

$$\mathcal{V} = \frac{A}{\phi_*^8} \left(1 + 2\, \mathfrak{b}\, \phi_*^{4/3}\right)^{-3} .$$

ϕ_* and $\mathcal{V}$ are lowered for $\mathfrak{b} > 0$, though the effect on the volume is weaker.

Different Possible Models of Kähler Moduli Inflation

Inflationary potential of Kähler moduli inflation takes a typical plateau-like form:

$$V = V_0 \left[1 - g(\phi) \right] ,$$

with:

$$V_0 \equiv V_{\rm sub}(\langle \mathcal{V} \rangle, \langle \tau_\phi \rangle) \qquad \text{and} \qquad g(\phi) \equiv \frac{V_{\rm sub}(\langle \mathcal{V} \rangle, \tau_\phi(\phi))}{V_{\rm sub}(\langle \mathcal{V} \rangle, \langle \tau_\phi \rangle)} \,.$$

Expression of $g(\phi)$ depends on

- ★ The origin (perturbative or non-perturbative) of the effects which generate $V_{\rm sub}(\langle \mathcal{V} \rangle, \tau_\phi)$
- ★ The topology of τ_ϕ (a bulk or local cycle) which gives the relation between τ_ϕ and ϕ

Different Possible Models of Kähler Moduli Inflation

$$V = V_0\,[1 - g(\phi)]$$

Expression of $g(\phi)$ depends on

- ★ Origin of the effects which generate $V_{\rm sub}(\langle\mathcal{V}\rangle, \tau_\phi)$
  - Non-perturbative effects (exponentially suppressed):

    $$V_{\rm sub}(\langle\mathcal{V}\rangle, \tau_\phi) \propto e^{-k\tau_\phi} \underset{\tau_\phi\to\infty}{\longrightarrow} 0 \qquad \text{for} \quad k > 0\,.$$

  - Perturbative effects (typically power-law):

    $$V_{\rm sub}(\langle\mathcal{V}\rangle, \tau_\phi) \propto \frac{1}{\tau_\phi^p} \underset{\tau_\phi\to\infty}{\longrightarrow} 0 \qquad \text{for} \quad p > 0\,,$$

- ★ Topology of τ_ϕ:
  - For a bulk modulus the canonical normalization introduces exponentials:

    $$\tau_\phi = e^{\lambda\phi} \qquad \text{with} \qquad \lambda \sim \mathcal{O}(1)\,.$$

  - For a local modulus the relation between τ_ϕ and ϕ is power-law:

    $$\tau_\phi = \mu\,\mathcal{V}^{2/3}\,\phi^{4/3} \qquad \text{with} \qquad \mu \sim \mathcal{O}(1)\,.$$

New Addition to Existing Models

- *Non-perturbative models*
  - Bulk fibre modulus: Non-perturbative Fibre Inflation

$$g(\phi) \propto e^{-k\, e^{\lambda\phi}} \ll 1 \qquad \text{for} \qquad \phi > 0\,.$$

  - Local blow-up modulus: Non-perturbative Blow-up Inflation

physically nonviable

$$g(\phi) \propto \; e^{-k\mu\, \mathcal{V}^{\mathbf{2/3}}\, \phi^{\mathbf{4/3}}} \ll 1 \qquad \text{for} \qquad \phi > 0\,.$$

- *Perturbative models*
  - Bulk fibre modulus: Loop Fibre Inflation

$$g(\phi) \propto e^{-p\lambda\phi} \ll 1 \qquad \text{for} \qquad \phi > 0\,.$$

  - Local blow-up modulus: Loop Blow-up Inflation

our new model!

[SB, Brunelli, Cicoli, Hebecker, Kuespert '24]

$$g(\phi) \propto \frac{1}{\mathcal{V}^{2p/3}\, \phi^{4p/3}} \ll 1 \qquad \text{for} \qquad \phi \lesssim 1\,.$$

First example in this class of constructions of a power-law inflationary potential.

Possible Future Directions

- Explicit computation of subleading loop corrections in a specific CY geometry
- Including additional perturbative corrections like higher F-term α'^3 effects

Thank you!