On de Sitter string vacua from anti-D3-branes in the Large Volume Scenario

Chiara Crinò

UNIVERSITÀ
DEGLI STUDI DI TRIESTE

CC, F. Quevedo, R. Valandro [ArXiv:2010.15903]
Cortona Young 2021

String Compactification

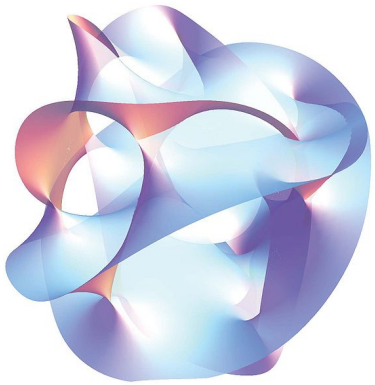
$$\mathcal{M}_{10d} = \mathbb{R}^{1,3} \times X_{6d}$$

Superstring theory: 10d

vs

Observations: 4d

$\Longrightarrow$



$\Downarrow$

Moduli

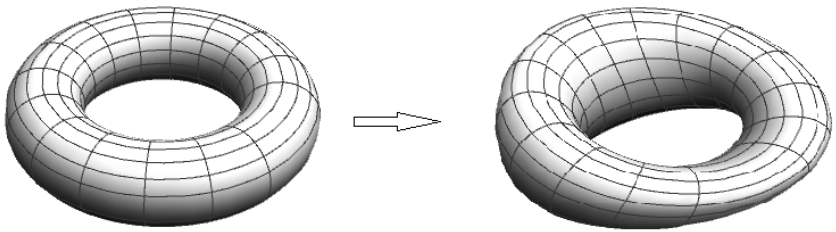
Moduli

Geometric deformations of the compact 6d manifold

Moduli

Geometric deformations of the compact 6d manifold

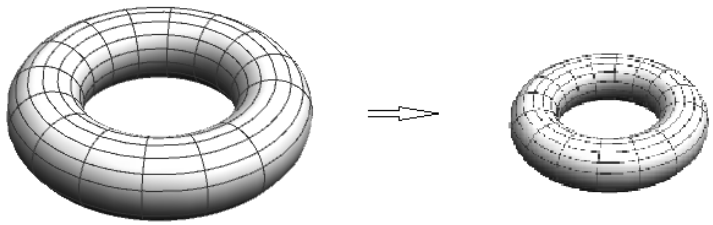
- Complex structure moduli: Z_α



Moduli

Geometric deformations of the compact 6d manifold

- Complex structure moduli: Z_α
- Kähler moduli: $T_i = \tau_i + i\theta_i$



Moduli

Geometric deformations of the compact 6d manifold

- Complex structure moduli: Z_α
- Kähler moduli: $T_i = \tau_i + i\theta_i$
- axio-dilaton $\leftrightarrow g_s$

Moduli

Geometric deformations of the compact 6d manifold

- Complex structure moduli: Z_α
- Kähler moduli: $T_i = \tau_i + i\theta_i$
- axio-dilaton $\leftrightarrow g_s$

4d: (Unobserved) massless scalar fields

$\Rightarrow$Moduli Stabilisation

Moduli

Geometric deformations of the compact 6d manifold

- Complex structure moduli: Z_α
- Kähler moduli: $T_i = \tau_i + i\theta_i$ **Fluxes**
- axio-dilaton $\leftrightarrow g_s$

4d: (Unobserved) massless scalar fields

$\Rightarrow$Moduli Stabilisation

Moduli

Geometric deformations of the compact 6d manifold

- Complex structure moduli: Z_α
- Kähler moduli: $T_i = \tau_i + i\theta_i$
- axio-dilaton $\leftrightarrow g_s$

Fluxes

Quantum Corrections

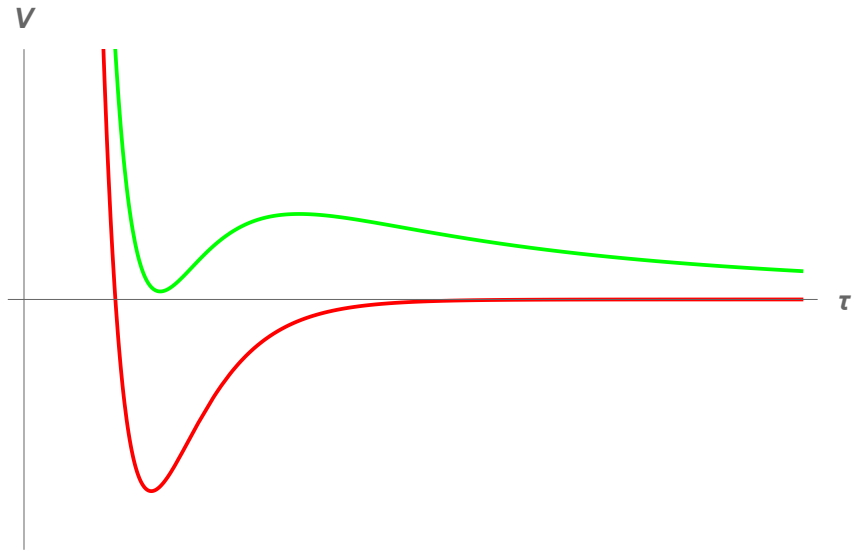
4d: (Unobserved) massless scalar fields

$\Rightarrow$Moduli Stabilisation

Moduli stabilisation and de Sitter vacua

Moduli stabilisation
(Flux compactification+KKLT/LVS)
vs
Cosmology

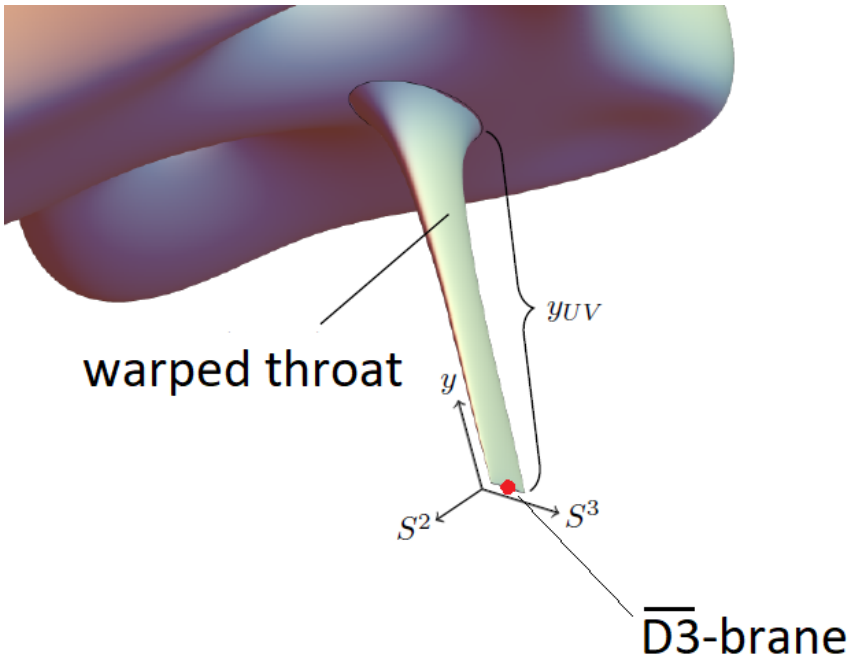
$\Rightarrow$



$\Downarrow$

New ingredients needed

Building a concrete example: our setup



(Image from [ArXiv:1902.07724])

- anti-D3 on top of O3
  $\rightarrow$ **Nilpotent goldstino** [ArXiv:1511.08105]
- Large Volume Scenario [ArXiv:hep-th/0502058]
- 2 Kähler moduli

$$\mathcal{V} = \tau_b^{3/2} - \tau_s^{3/2}$$

- Explicit stabilisation of the complex structure modulus parametrizing the throat

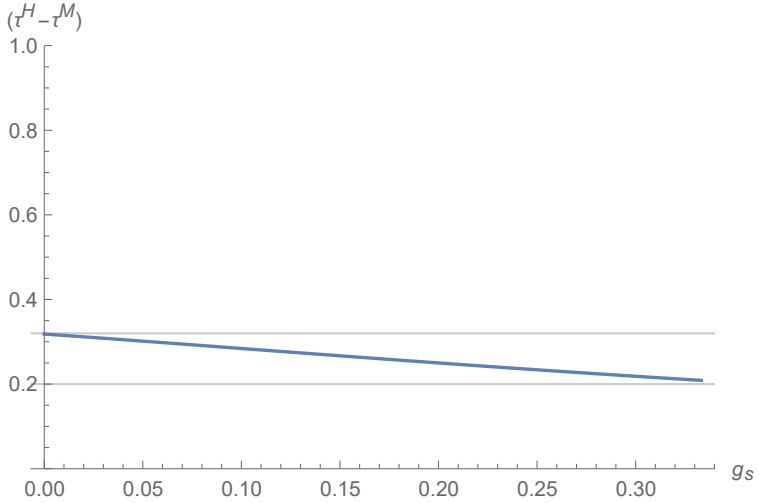
Building a concrete example: Constraints

- *dS minimum:* $V_{min} \gtrsim 0$
- *EFT:* $g_s \ll 1;\ \mathcal{V} \gg 1$
- *Consistency of the 4d description:*

$$M_p \gg M_s \gtrsim M_{KK}^{(i)} \gg m_{moduli}, m_{3/2}$$

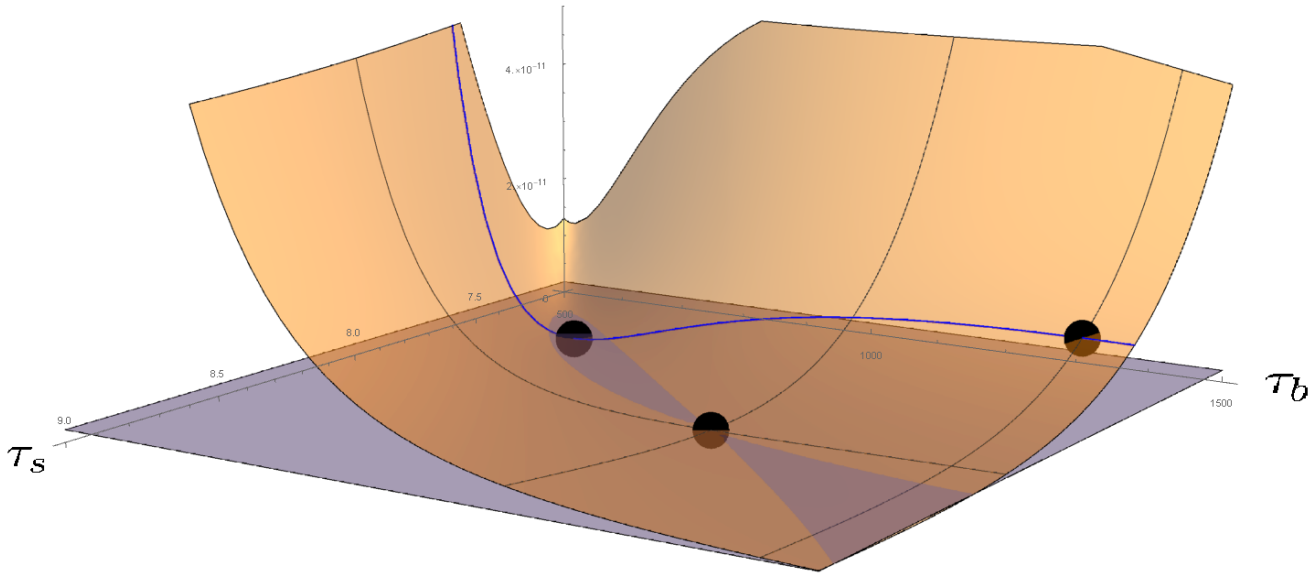
- *SUGRA:* $g_s|M| \gg 1$
- *D3-charge cancellation:*

$$Q_{D3}^{flux} = MK < |Q_{D3}^{O3/D3/D7}| = 149$$



Building a concrete example: results

$\chi = -260$
$W_0 = 23$
$g_s = 0.23$



$\mathcal{V} = 1.9 \times 10^4$
$V_{min} = 10^{-12}$
$MK = 88$

- All moduli stabilised
- de Sitter vacuum
- Small expansion parameters
- All constraints satisfied

What's next?

- Explicit complex structure moduli stabilisation
- More realistic models

dS uplift via $\overline{D3}$ – branes

Moduli stabilisation

Chirality

Inflation [ArXiv:1709.01518]

1. **Find a (toric) CY geometry**
   - $h^{1,1} \geq 4$
   - LVS
   - K3-fibred
   - $\overline{D3}$-brane uplift: throat with O3-planes
   - Non-trivial D7-branes configuration
   - Only one non-vanishing gauge flux
2. **Build an explicit example**

Thanks!