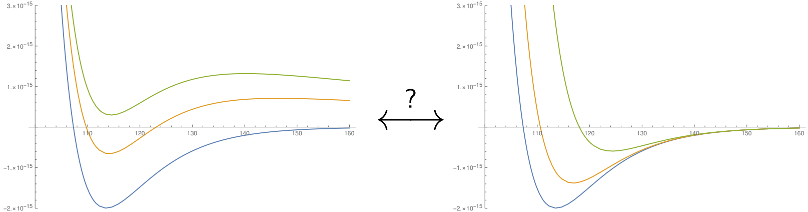
TOWARDS DE SITTER FROM TEN DIMENSIONS

with Ander Retolaza and Alexander Westphal [arXiv:1707.08678]



$$R_{\mu\nu} - \frac{1}{2} R g_{\mu\nu} + \Lambda_{cc} g_{\mu\nu} = T_{\mu\nu}$$

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step 3: Uplift to de Sitter using $\overline{D}3$-brane. $m_{\overline{D3}} \sim m_{wKK}$.

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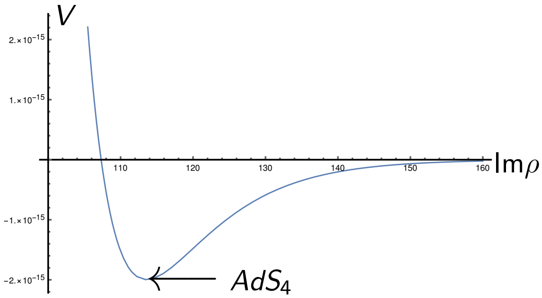
At low energies (step 2):

$$W = W_0 + Ae^{ia\rho}\,,$$

$$W_0 \sim \int G_3 \wedge \Omega\,, \quad Ae^{ia\rho} \sim \langle\lambda\lambda\rangle\,.$$

KKLT (continued)

From this, get:



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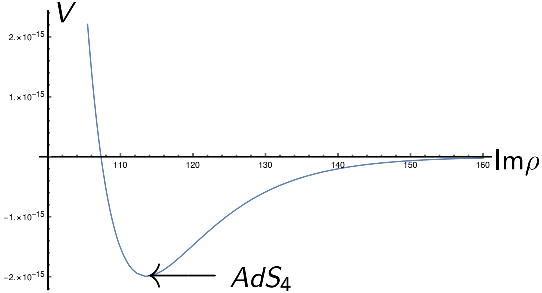
From this, get:



Crucial relations:

$$e^{ia\rho_0} \sim W_0 \,,$$

$$V_0(\rho_{min}) \sim -m_\rho^2 M_P^2 \sim -M_P^4 e^{-2a\mathrm{Im}\rho_0} \,.$$

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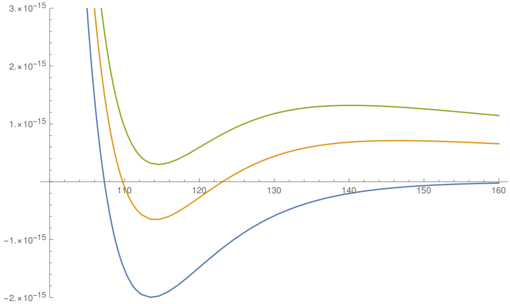
Properties:

"naturally small" + "$\approx$ constant in ρ"

THE KKLT UPLIFT (continued)



featuring: Tunable cosmological constant.

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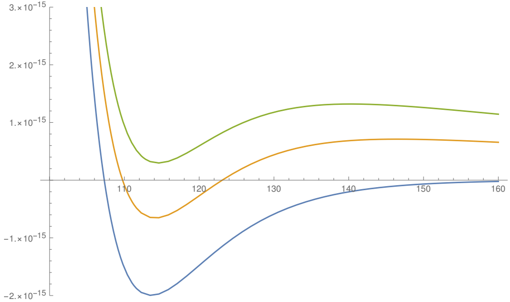

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caveat: $V_{\overline{D3}}$ is "classical"

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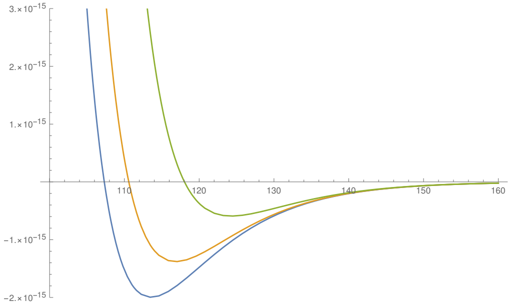

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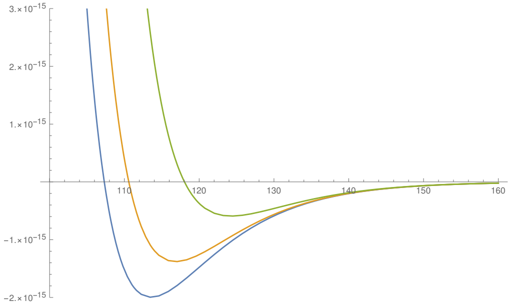

So, what is $V_{\overline{D3}}(\rho)$?

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Fact II: Perturbed background is SUSY! [Dymarsky,Martucci'11]

THE 10D ON SHELL POTENTIAL

Approach: Check, if $S_{IIB} + S_{\lambda\lambda} + S_{\overline{D3}}$ evades no-go theorems for dS [Maldacena,Nunez '00],[GKP],...

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Can be phrased in terms of

on-shell $4d$ potential(s) $\equiv$ $4d$ potential mod e.o.m.

THE TYPE IIB ON SHELL POTENTIAL

For (Einstein frame) type IIB SUGRA:

$$V \propto \int_{M_6} \left(-e^{8A}\frac{\Delta}{2\pi} - |\partial\Phi^-|^2\right) ,$$

$$\Delta = 2\pi|G^-|^2 + \Delta^{loc} .$$

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So, need $\Delta^{loc} < 0$ for dS! [GKP],...

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We find: (in Sen limit [Sen '96])

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with $\overline{D3}$ uplift:

Still $\Delta_{\lambda\lambda} > 0$ and $\Delta_{\overline{D3}} > 0$. $\rightarrow$ $V_{KKLT} \overset{!}{<} 0$.

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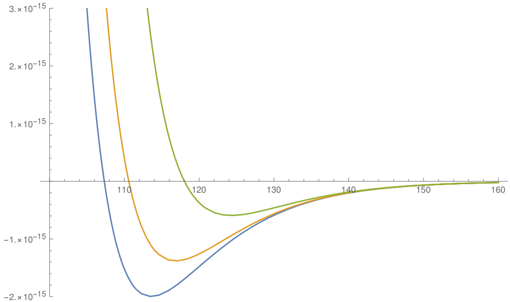

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Indeed, in $10D$:

$$V \propto \int 3 \sum_a \left| \langle\lambda\lambda\rangle_a \nabla_i \nabla_j \Psi^{\Sigma_a} \right|^2 - 4 \left| \sum_a \langle\lambda\lambda\rangle_a \nabla_i \nabla_j \Psi^{\Sigma_a} \right|^2$$

& no-go is evaded.

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- Outlook:
  - $\langle\lambda\lambda\rangle \sim e^{ia\rho}$ from $10D$?
  - Explicit realization of racetrack à la KL?
  - α'-corrections, LVS etc.
  - Explicit backreaction study, e.g. corrected warp factor?

–THE END–

BACK UP SLIDE

What is Δ^{loc}?

$$\Delta^{loc} \equiv \frac{1}{4}(T^m_m - T^\mu_\mu)^{loc} - T_3 \rho_3^{loc}$$

For $D3, \overline{D3}, O3, \overline{O3}$: $\quad \Delta^{loc} = \text{tension} - \text{charge}_{D3}$

For $D7, O7$: $\quad \Delta^{loc} = 0.$

For $D5, O5$: $\quad \Delta^{loc} = \frac{1}{2}(\text{tension})$