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Dark Bubble Phenomenology

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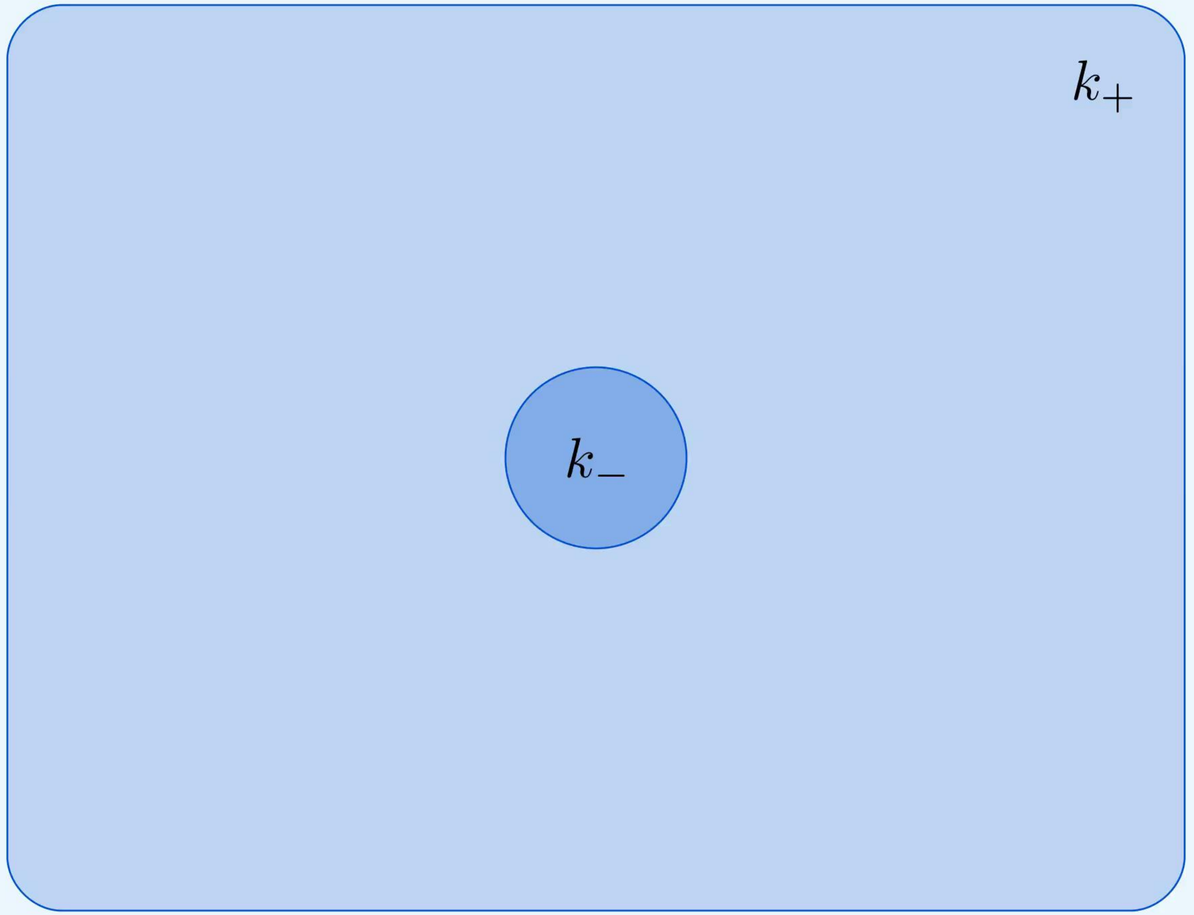
In this talk ...

- Introduce the Dark Bubble model
- Embed the DB into String Theory
- Derive precise and numerical PHENO values from the DB embedding

What is the Dark Bubble model?

[Banerjee, Danielsson, Dibitetto, Giri, Schillo, 1807.01570]



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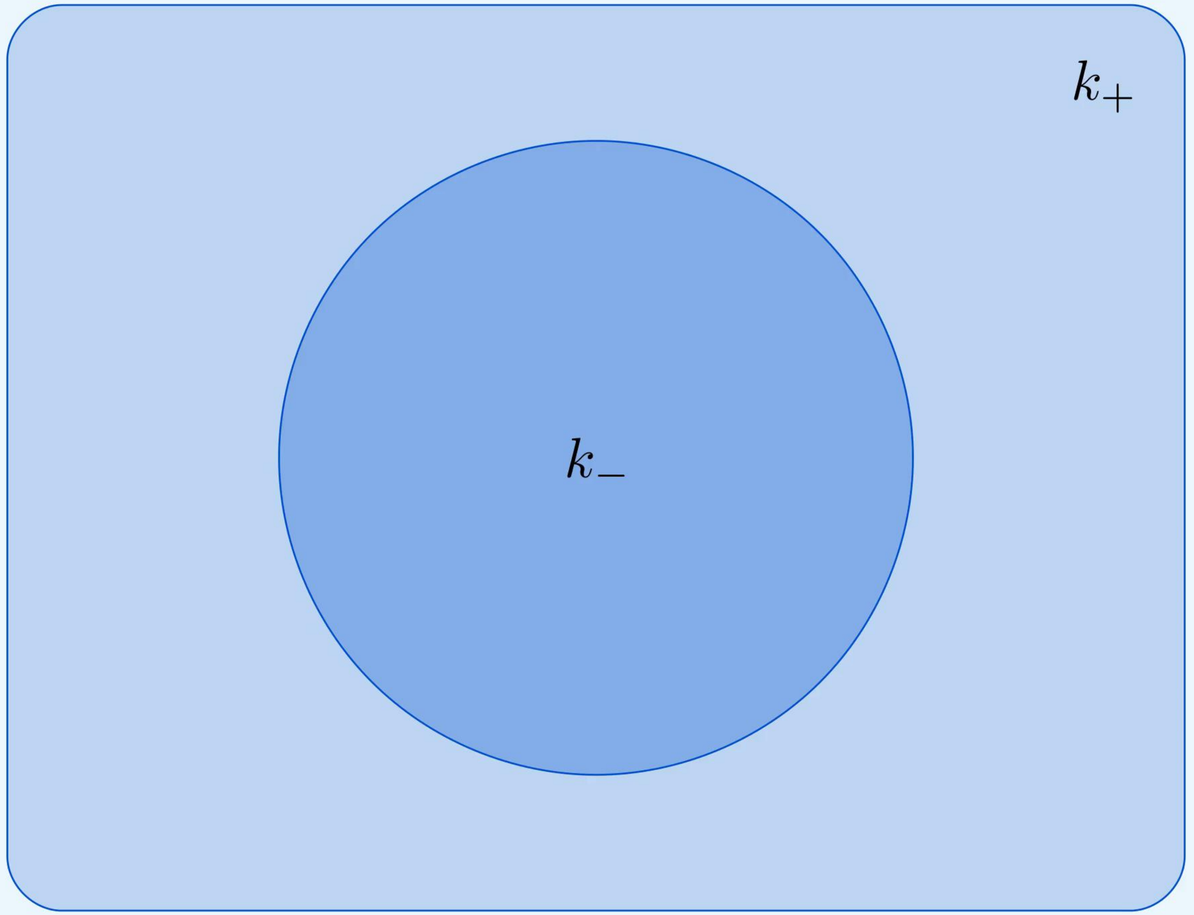


Motivations and Foundations

[Danielsson, Van Riet,1804.01120] [Obied, Ooguri, Spodyneiko,Vafa, 1806.08362] [van Beest, Calderón-Infante, Mirfendereski, Valenzuela, 2102.0111]

- To obtain models with $\Lambda_4 > 0$ from UV complete theories remains as an open question
- de Sitter may belong to Swampland

- Non supersymmetric AdS vacua decay
- CdL instantons
- Junction conditions

[Oouguri, Vafa, 1610.01533]

[Coleman, de Lucia,Phys. Rev. D 21, 3305, 1980]

[W. Israel, Nuovo Cim. B44S10, (1966)]

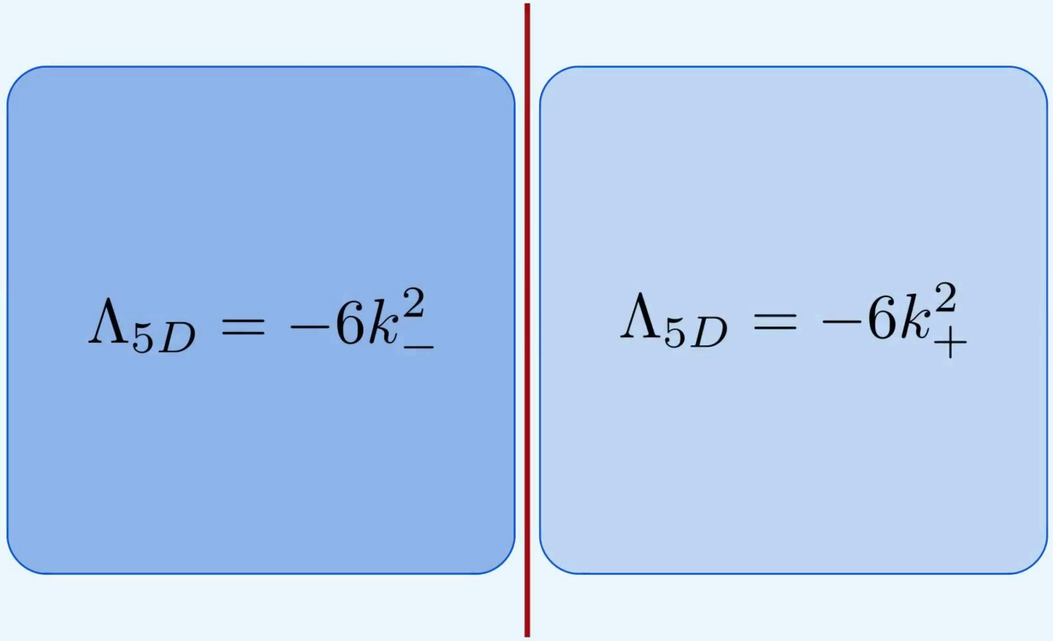
Junction Conditions: A Toll across Vacua

[W. Israel, Nuovo Cim. B44S10, (1966)]

- Main question: What should the brane's $T_{\mu\nu}$ be so that the whole configuration is GR solution?

$$h_{ab}^{(+)} = h_{ab}^{(-)}$$

$$S_{ab} = \kappa_5^{-1} \left([\Delta K_{ab}]_-^+ - [\Delta K]_-^+ h_{ab} \right)$$



Riding the Bubble

[Banerjee, Danielsson, Dibitetto, Giri, Schillo, 1807.01570]

$$ds^2 = -N^2 d\tau^2 + a^2 d\Omega_3^2$$

$$\sigma = \frac{3}{\kappa_5}\left(\sqrt{k_-^2 + \frac{1+\dot{a}^2}{a^2}} - \sqrt{k_+^2 + \frac{1+\dot{a}^2}{a^2}}\right)$$

k_+

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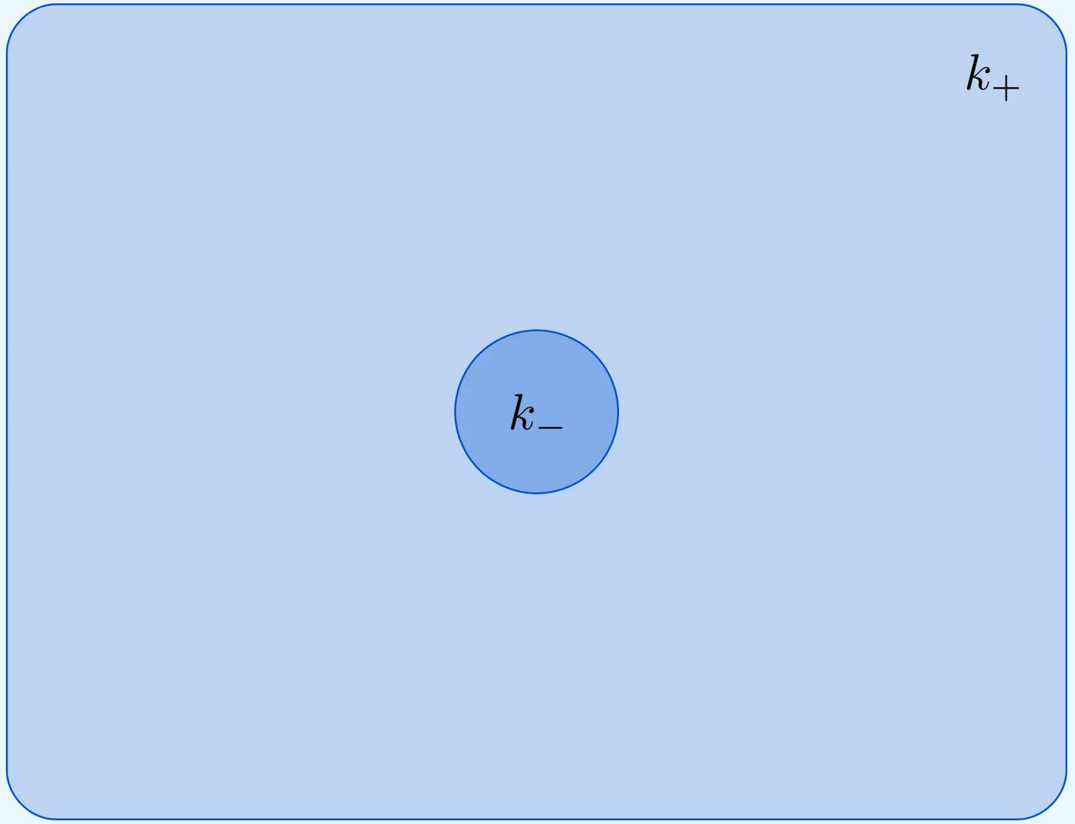

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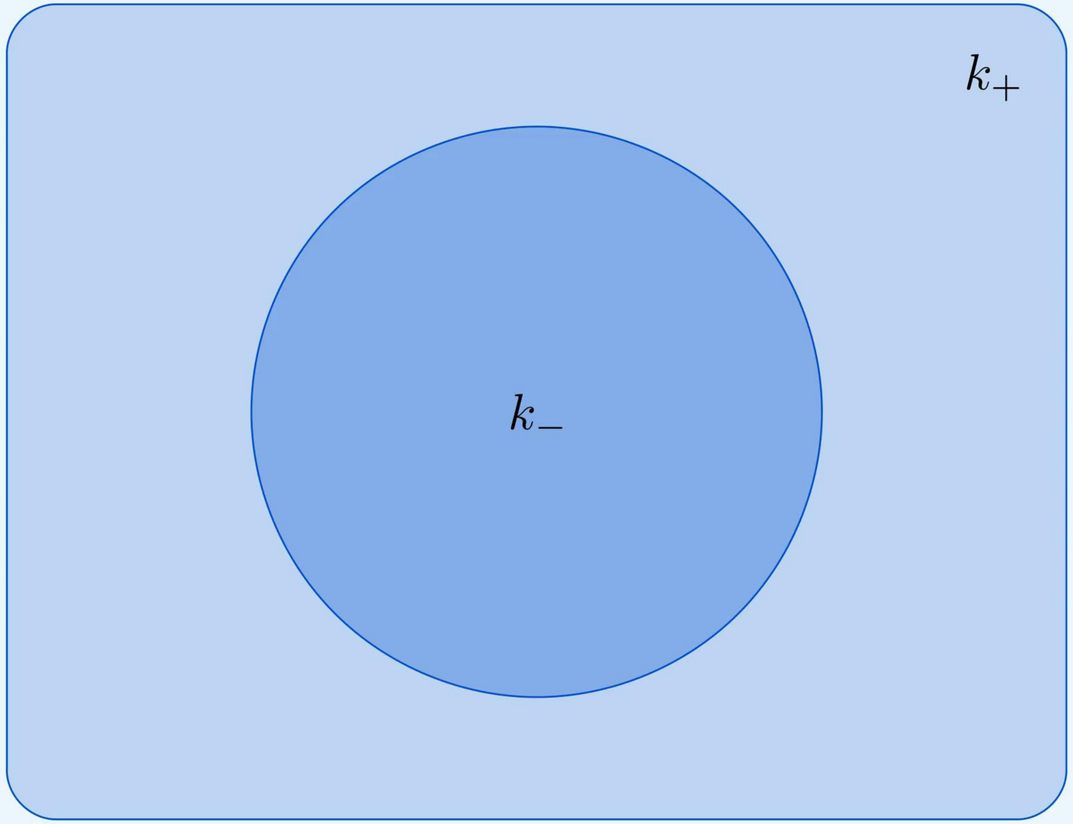

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Riding the Bubble

[Banerjee, Danielsson, Dibitetto, Giri, Schillo, 1807.01570]

$$\left(\frac{\dot{a}}{a}\right)^2 = -\frac{1}{a^2} + \frac{8\pi}{3}\underbrace{2\left(\frac{1}{k_-} - \frac{1}{k_+}\right)^{-1} G_5}_{G_4}\underbrace{(\sigma_{cr} - \sigma)}_{\rho_\Lambda} + \mathcal{O}(\epsilon^2)$$

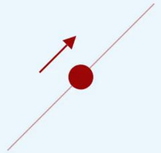
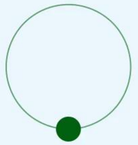
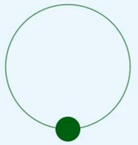
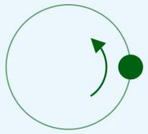
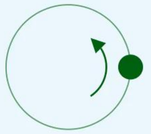
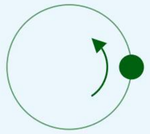
Riding the Bubble

[Banerjee, Danielsson, Dibitetto, Giri, Schillo, 1807.01570]

$$\left(\frac{\dot{a}}{a}\right)^2 = -\frac{1}{a^2} + \frac{8\pi}{3} G_4 \rho_\Lambda + \mathcal{O}(\epsilon^2)$$

Dark Bubble embedding in String Theory

[Danielsson, Henriksson, DP, 2211.10191]

α	β	γ	$\mathfrak{R}$	Θ	Ψ	Φ_1	Φ_2	Φ_3
								

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			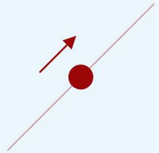	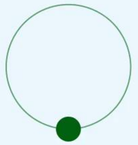	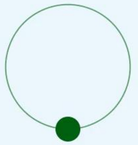	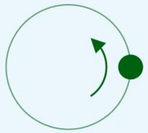	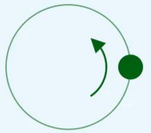	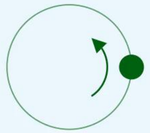

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			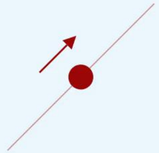	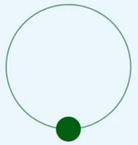	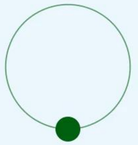	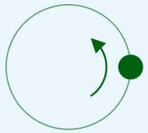	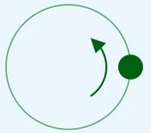	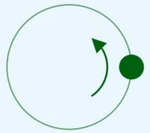

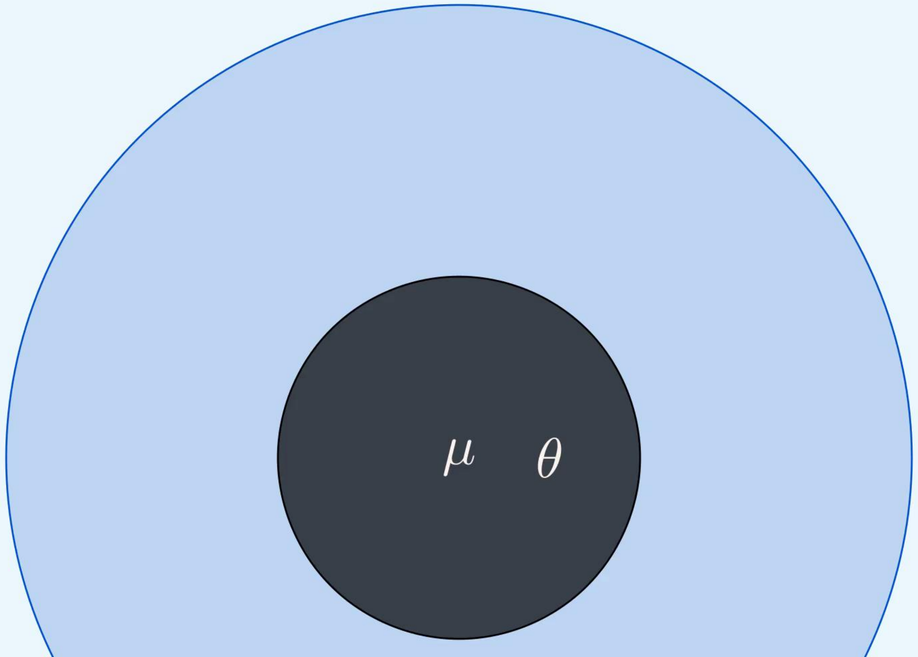

Dark Bubble Phenomenology

[Danielsson, DP, 2311.14589]

$$S[g_{\mu\nu}, C_4] = \mathrm{DBI}^{(0)} + \alpha'^2 \mathrm{DBI}^{(2)} + \mathrm{WZ}^{(0)} + \alpha'^2 \mathrm{WZ}^{(2)}$$

$$\underbrace{\frac{N^{1/2}}{2\sqrt{3}\,\pi}\,\ell_4}_{L} \gg \underbrace{\frac{N^{1/4}}{2^{3/4}\sqrt{3}\,\pi^{3/8}}\,\ell_4}_{\ell_{10}} \gg \ell_4 \gg \underbrace{\frac{N^{-1/6}}{\sqrt{3}(2\pi)^{1/3}}\,\ell_4}_{\ell_5}$$

$$\sigma \sim T_{D3}\left(1 - \frac{1}{g_s N}\right)$$

Dark Bubble Phenomenology

[Danielsson, DP, 2311.14589]

Scale	Length(m)	Energy
L	5.1×10^{-5}	$3.8\,\mathrm{meV}$
$\sqrt{\alpha'}$	1.8×10^{-20}	$11.2\,\mathrm{TeV}$
$\tilde{\ell}_{10}$	1.4×10^{-20}	$13.7\,\mathrm{TeV}$
$\tilde{\ell}_5$	3.9×10^{-45}	$5.1 \times 10^{28}\,\mathrm{TeV}$

$$\alpha_{\mathrm{EM}} = \frac{3}{2} g_s$$

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Summary and Outlook

- Alternative to realise $\rho_\Lambda > 0$ from String Theory
- New hierarchy of scales, with precise values from embedding

- Dark Bubble & the Standard Model
- To explore the Bubble-scape

¡Gracias!