Analytic de Sitter vacua in maximal Supergravity

Marco Gorghetto
Master's thesis under the supervision of Prof. G. Dall'Agata

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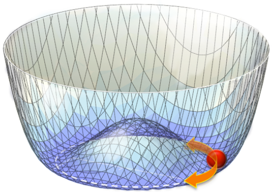

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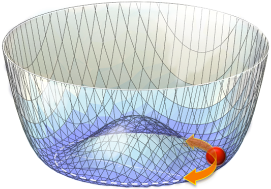

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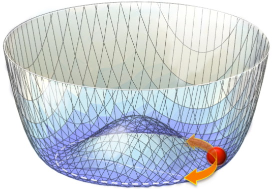
  - need to couple supersymmetric theories to gravity



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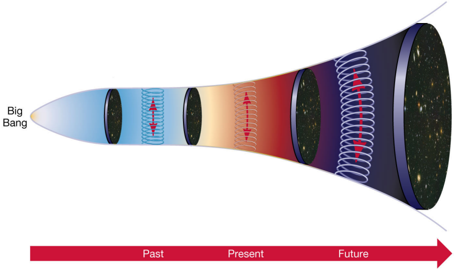

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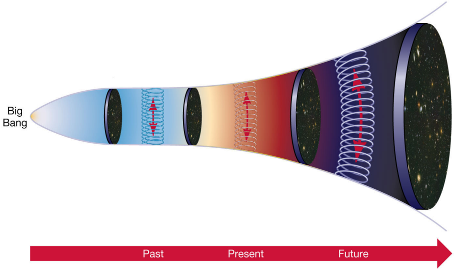

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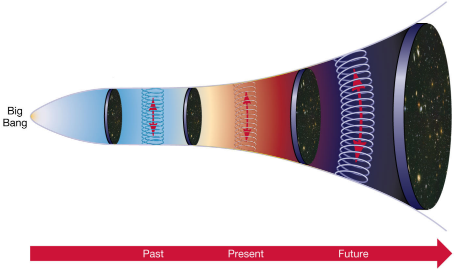

- In a supergravity theory with $e^{-1}\mathcal{L} = \cdots - V(\phi)$, $\Lambda = V(\phi_0)$

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- Descends from M-theory
  - low energy limit
  - compactification of extra dimensions on $\mathbb{T}^7$
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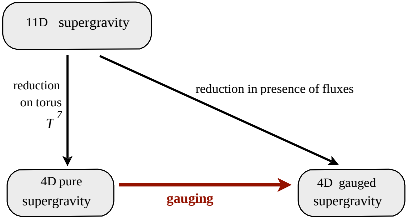

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   - $W = W_0 + W_\alpha \Phi^\alpha + \frac{1}{2!} W_{\alpha\beta} \Phi^\alpha \Phi^\beta + \frac{1}{3!} W_{\alpha\beta\gamma} \Phi^\alpha \Phi^\beta \Phi^\gamma$

SO(8) gauged supergravity: results

	Residual sym	Λ	Scalar square masses: $m^2_{(\text{multiplicity})}$
(i)	SO(8)	-3	$-\frac{2}{3}{}_{(14)}$
(ii)	SO(7)	-4	$2_{(1)}, -\frac{4}{5}{}_{(6)}, -\frac{2}{5}{}_{(7)}$
(iii)	SO(6)	$-\frac{25\sqrt{5}}{16}$	$2_{(2)}, -1_{(5)} - \frac{1}{4}{}_{(4)}, 0_{(3)}$
(iv)	SO(7)	$-5^{3/4}$	$2_{(1)}, -\frac{4}{5}{}_{(6)}, -\frac{2}{5}{}_{(7)}$
(v)	G_2	$-\frac{108}{25}\sqrt{\frac{2}{5}}\sqrt[4]{3}$	$\frac{4+\sqrt{6}}{3}{}_{(1)}, -\frac{11+\sqrt{6}}{18}{}_{(6)}, \frac{4-\sqrt{6}}{3}{}_{(1)}, \frac{-11+\sqrt{6}}{18}{}_{(6)}$

Table: Vacua of the truncated theory for $G_g = SO(8)$

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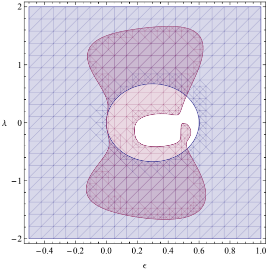
1.3 Perturb these conditions to search for de Sitter vacua:
   - $W_0 \to W_0(\epsilon, \lambda), W_S \to W_S(\epsilon, \lambda), W_T \to W_T(\epsilon, \lambda), W_U \to W_U(\epsilon, \lambda)$

Isotropic model: results

- Sample of perturbation parameters around a no-scale vacuum:

  $(W_0, W_S, W_T, W_U) = \left(1, \frac{1}{2} + \epsilon, (1+i)\epsilon, \frac{3}{2} + \lambda\right)$

  - Blue: de Sitter vacua
  - Purple: strictly stable vacua



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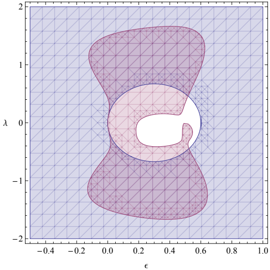

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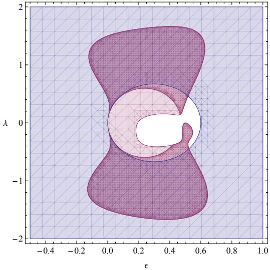

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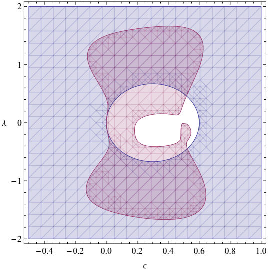
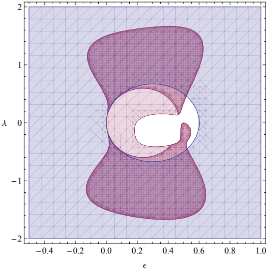


2. Vacua in the unconstrained model (with 7 moduli) for the same value of the perturbation parameters
   - Just some anti de Sitter vacua become unstable
   - All vacua become marginally stable (with 4 flat directions)



Conclusions and outlook

- We determined analytically a set of de Sitter vacua in a truncation of maximal supergravity.
- How can the vacua be reproduced in the $N = 8$ landscape?
- Are all of them upliftable to $D = 11$ supergravity?