

The Swampland and stringy cosmology

Oxford Theoretical Studies of Particles and Strings retreat

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Many beautiful things to study in string theory

- Calabi-Yau geometry (special holonomy generally)
- Supersymmetry
- AdS Holography

(interrelated: CY compactification leads to SUSY in lower dimension; holographic theories usually supersymmetric)

Our world/cosmology

- Calabi-Yau geometry (special holonomy, generally)
- Supersymmetry
- AdS Holography

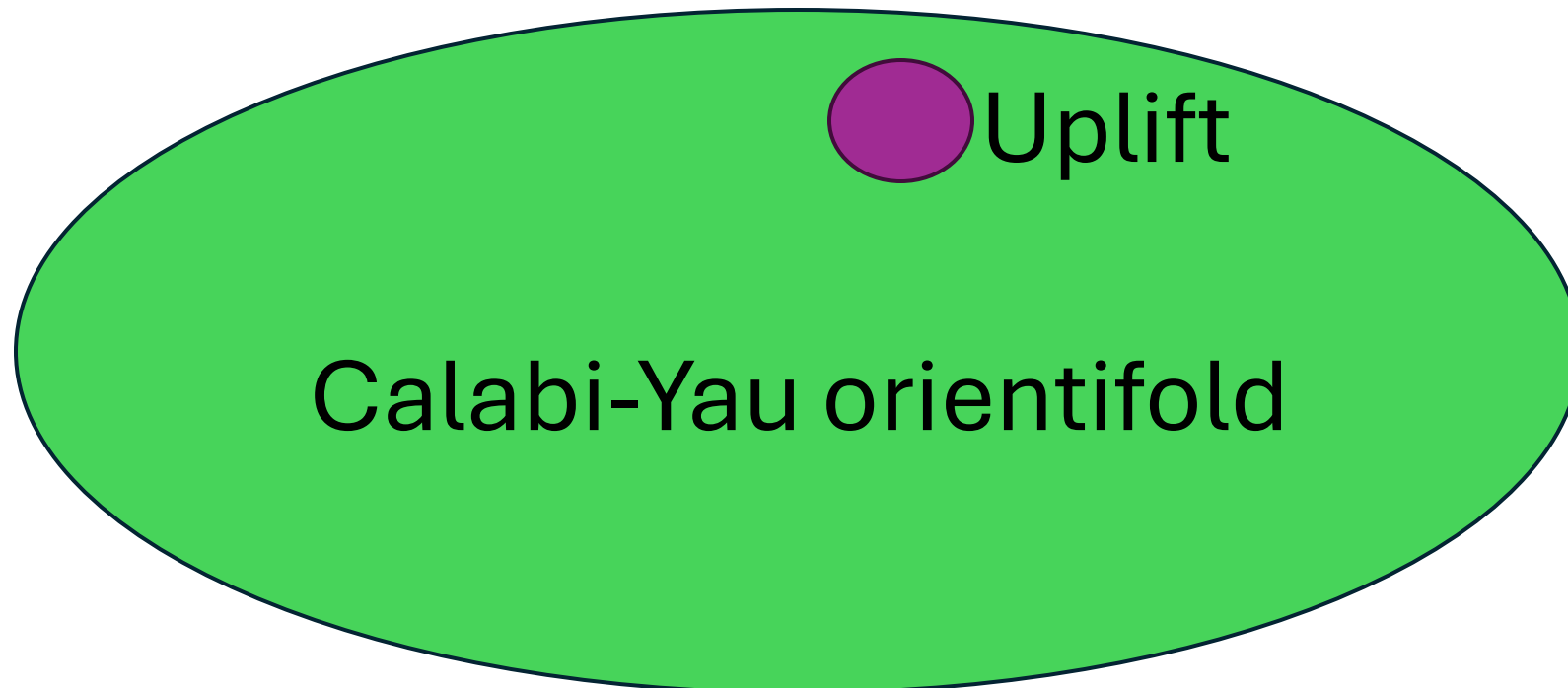
(interrelated, but not necessarily SUSY in lower dimensions; holographic theories use supersymmetry)

No SUSY seen; positive vacuum energy

String phenomenology

Can we get something like our world in string theory (in a controlled way) ?

Start from what we know and control and modify slightly:



Control issues (KKLT)

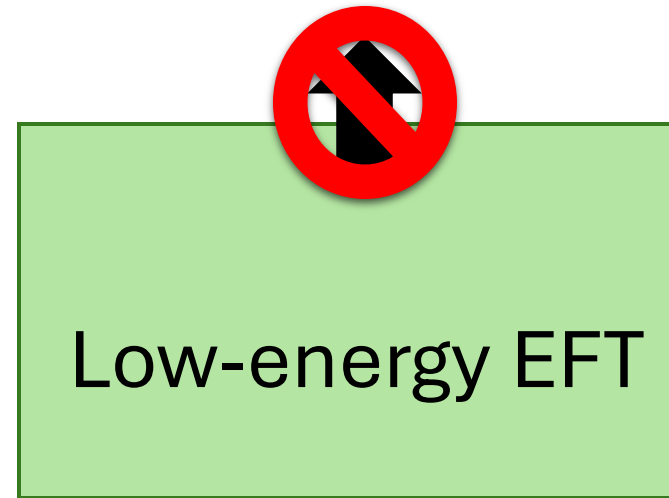
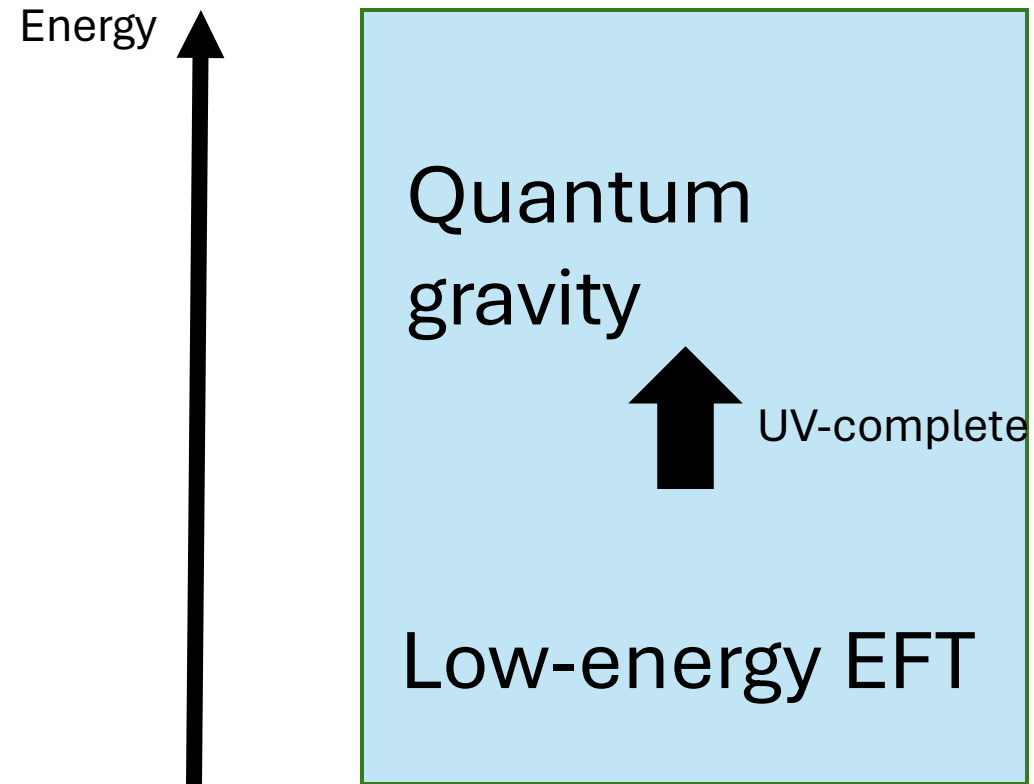
Magnitude negative vacuum energy V_{AdS} related to Calabi-Yau volume => Bigger volume requires bigger uplifting region

Control against higher order corrections is a struggle. Status of de Sitter vacua in string theory still unclear



Landscape

Swampland



Swampland program: conjecture and argue for web of consistency conditions

Festina Lente conjecture

Demand charged black holes evaporate back to empty de Sitter space

All charged particles should obey

$$m^2 \gtrsim q g M_P H$$

Also implies nonabelian gauge theories must be Higgsed or confined; implies relatively heavy Higgs

UV/IR Mixing

The de Sitter uplift affects everything

Is it possible to play particle physics and cosmology as separate games or is everything tied together?

