NEW STRING THEORIES FROM DISCRETE THETA ANGLES

Based on [2209.0336], in collaboration with Héctor Parra de Freitas

Miguel Montero
Harvard

Back to the Swamp, IFT Madrid

September 27th 2022

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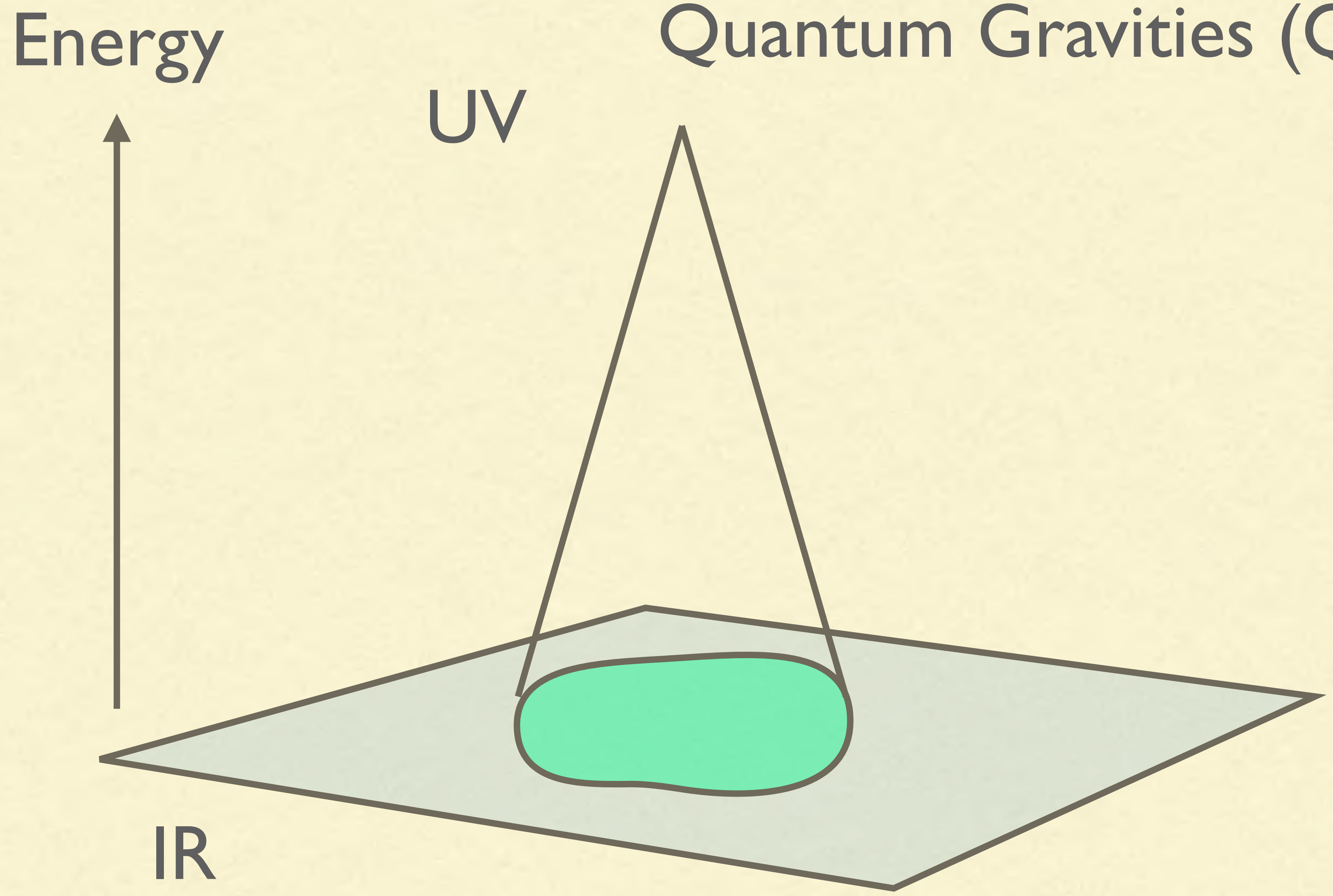

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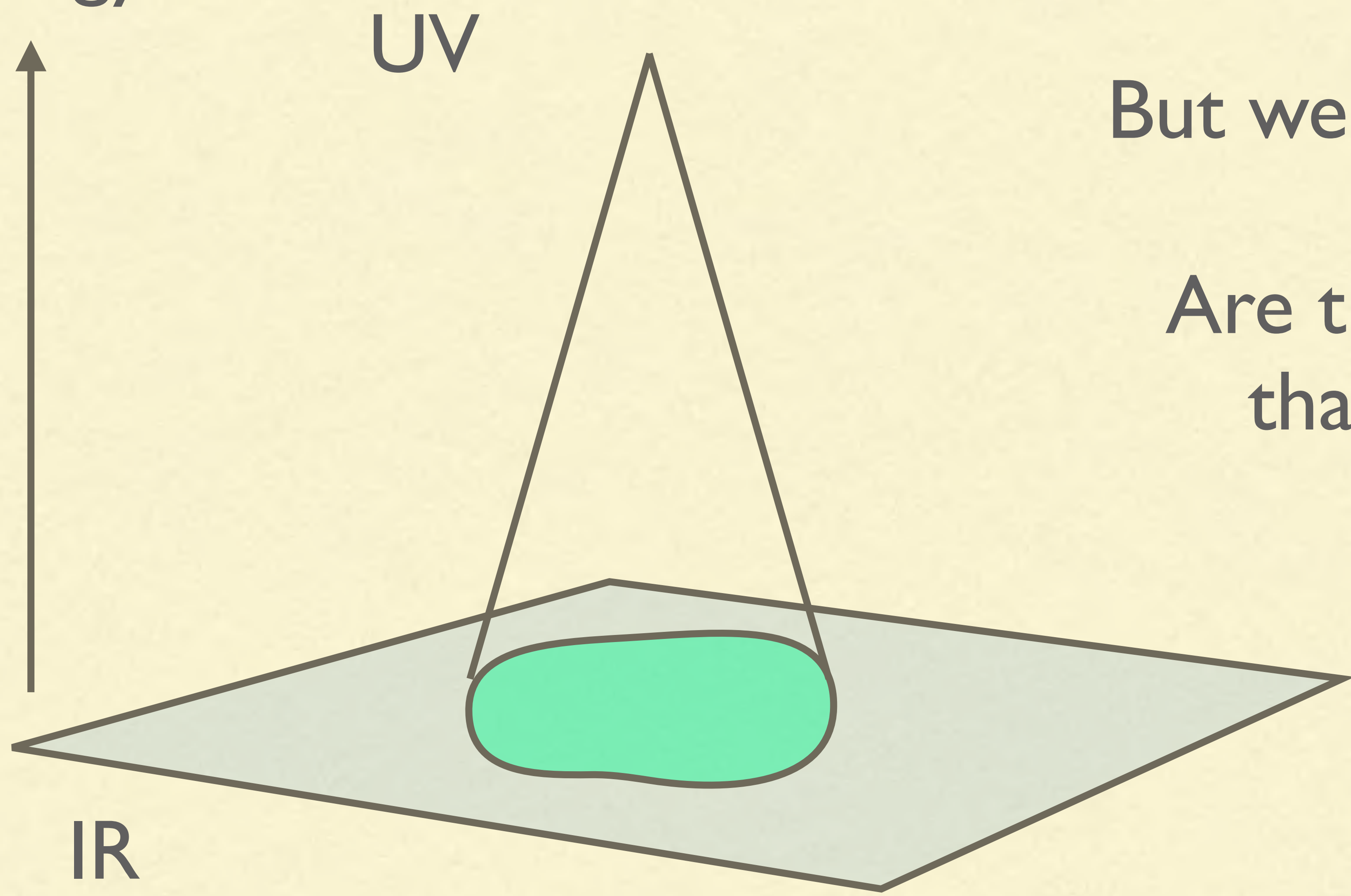

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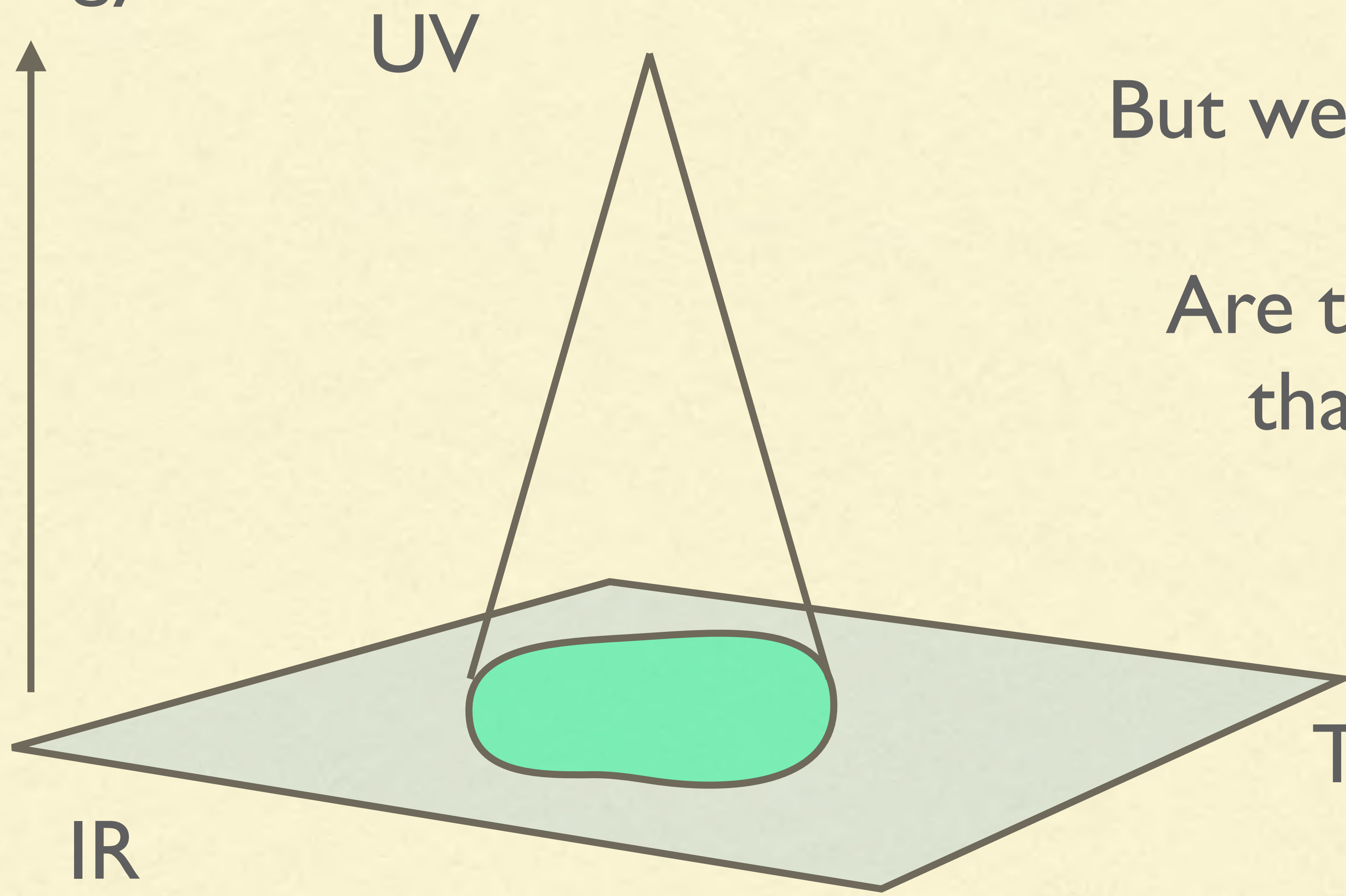

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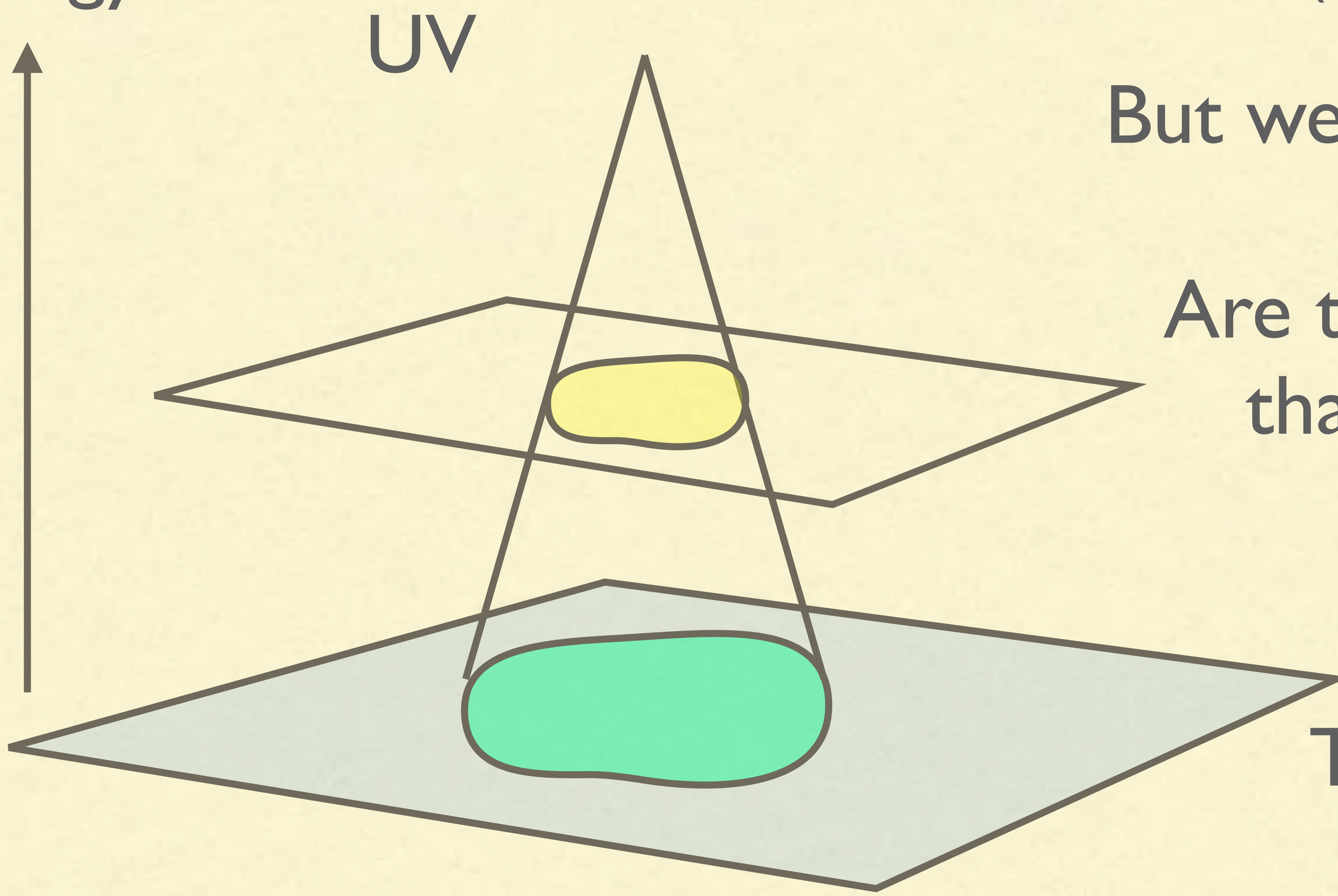

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since the theories may be distinguishable at an **intermediate** energy scale

-Spectrum of massive states

-Higher-derivative & topological terms

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Topological couplings that are invisible in the IR, but change the theory

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It describes **one of two** known components of the moduli space of QG with 16 supercharges with one vector, i.e. **rank one.**

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A: It was, but it led to **nonsense!**

Recall the description of type I string theory as an O9 orientifold of IIB with 32 D9 branes.

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Seemed like a new 10d string theory, but under e.g T-duality it led to inconsistencies.

It was not clear to many of us what was the deal with this theory. Do dualities work differently? Is it illegal to set C0=1/2?

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We also checked this is consistent with duality, spectrum of strings & branes.

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2-form B in gravity multiplet $\longleftrightarrow$ Strings charged under B

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For AOB or DP, $B = B_2^{NSNS}$ or $B = C_2^{RR}$

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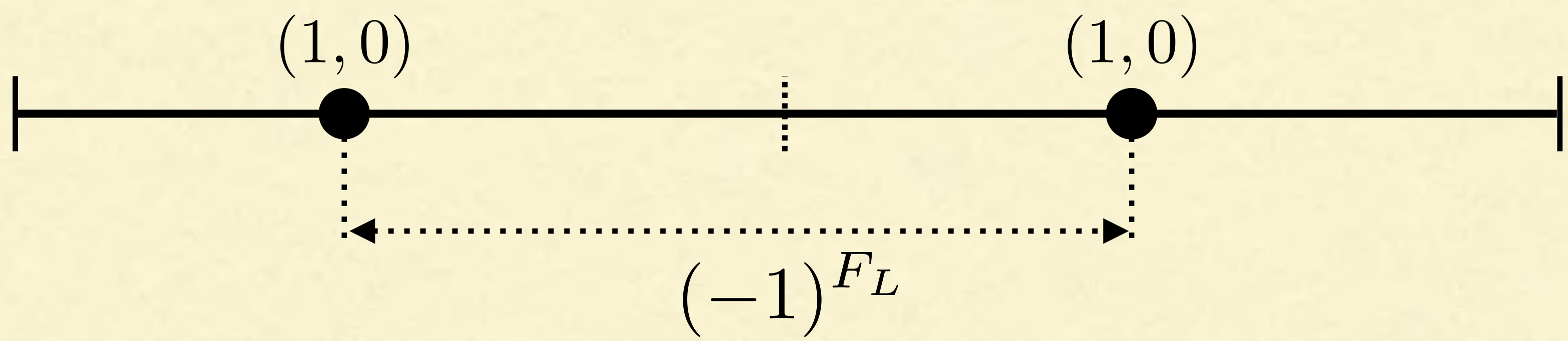

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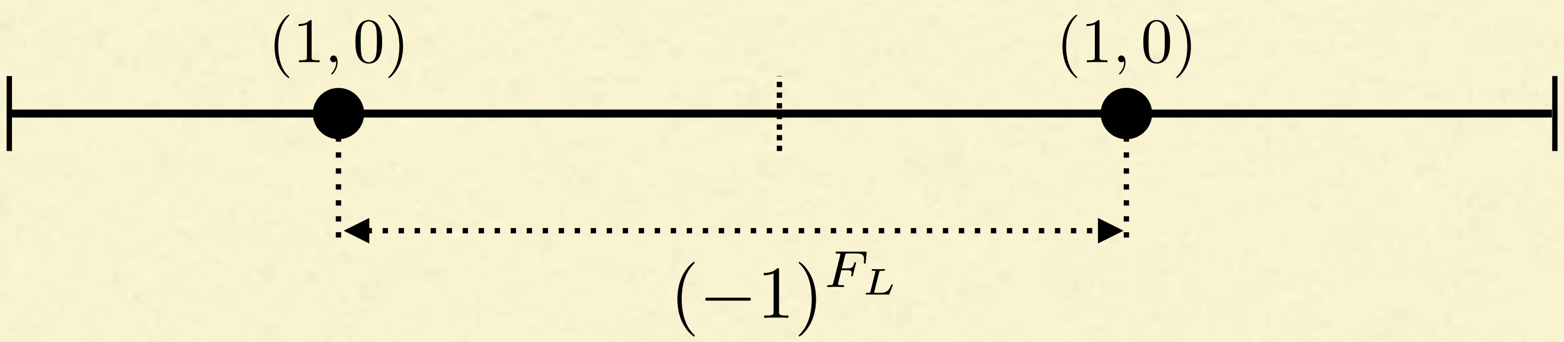

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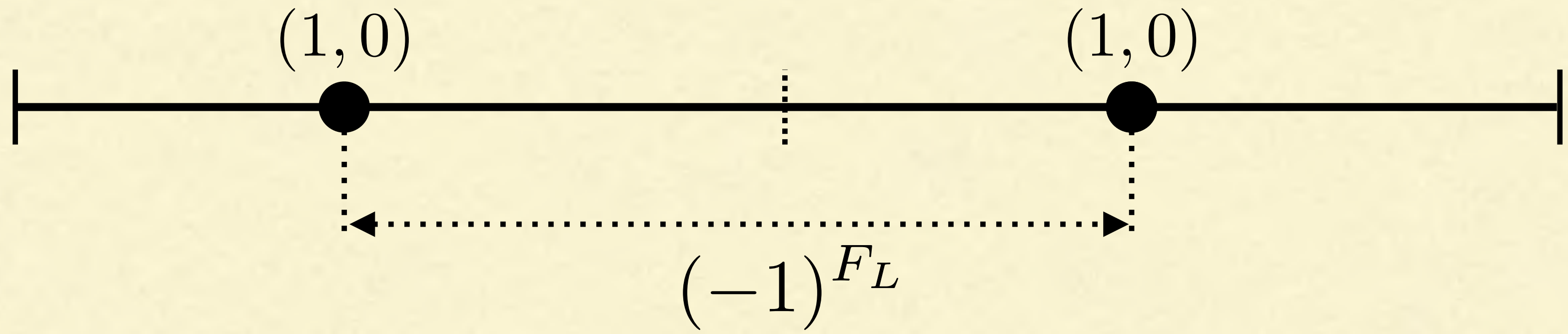

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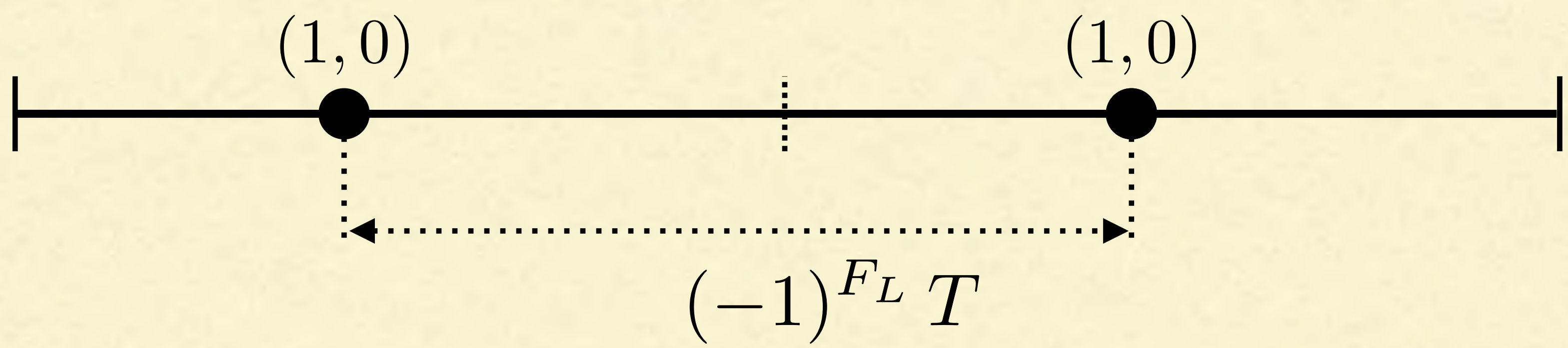

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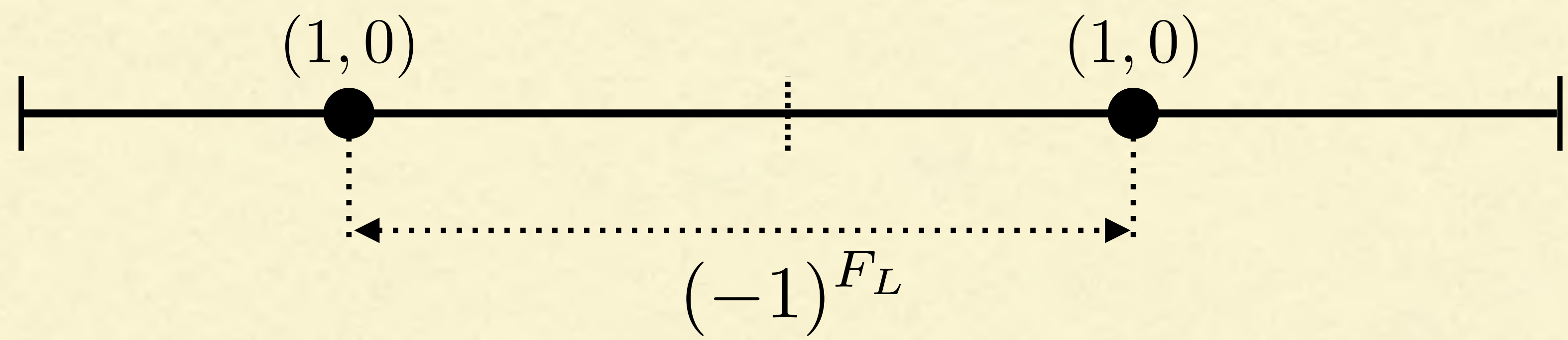

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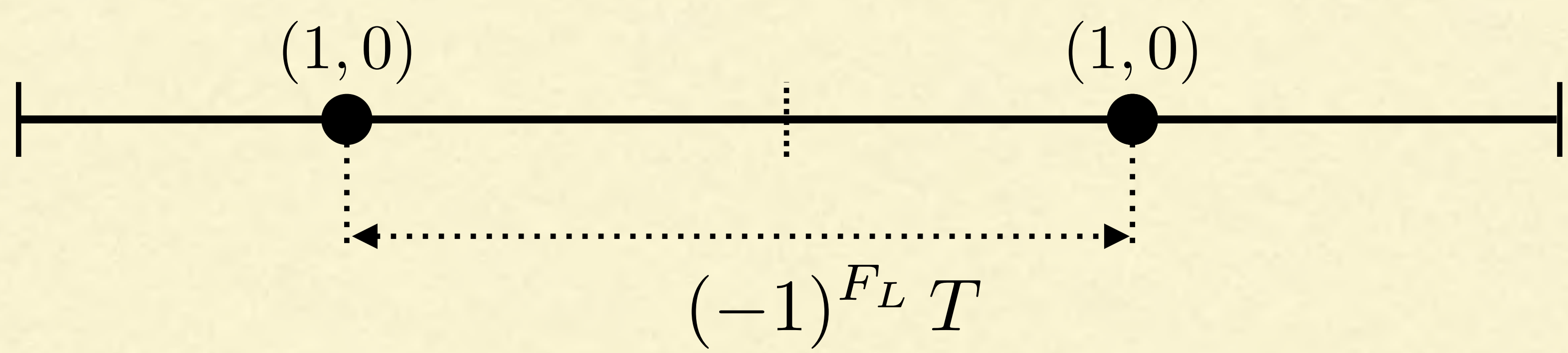

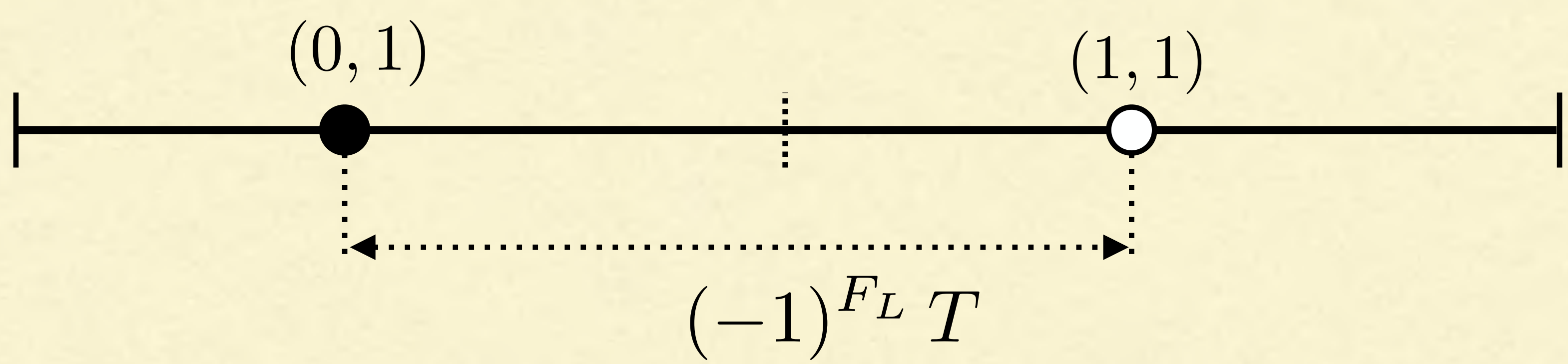

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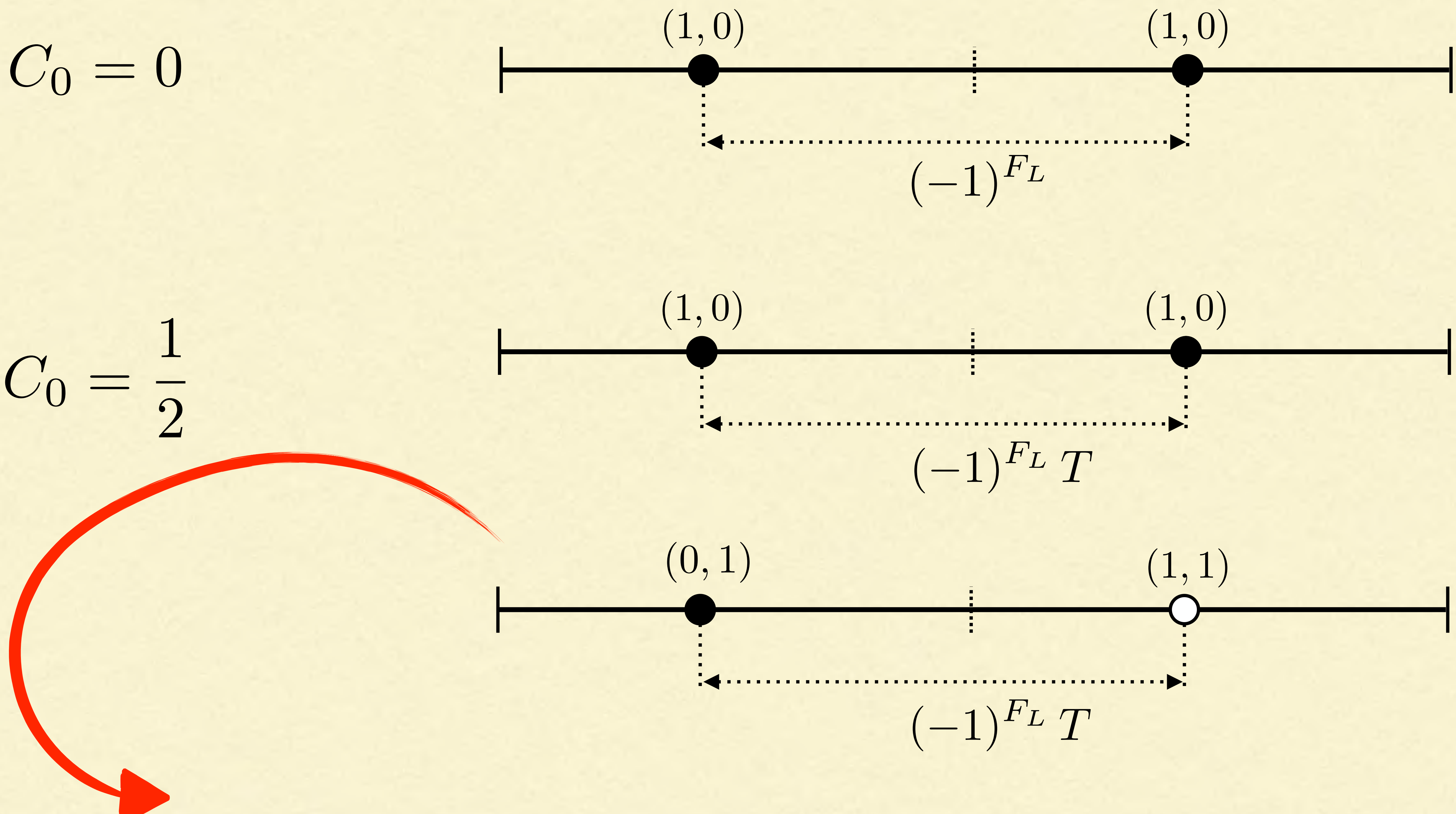

String of smallest charge is **non-BPS**

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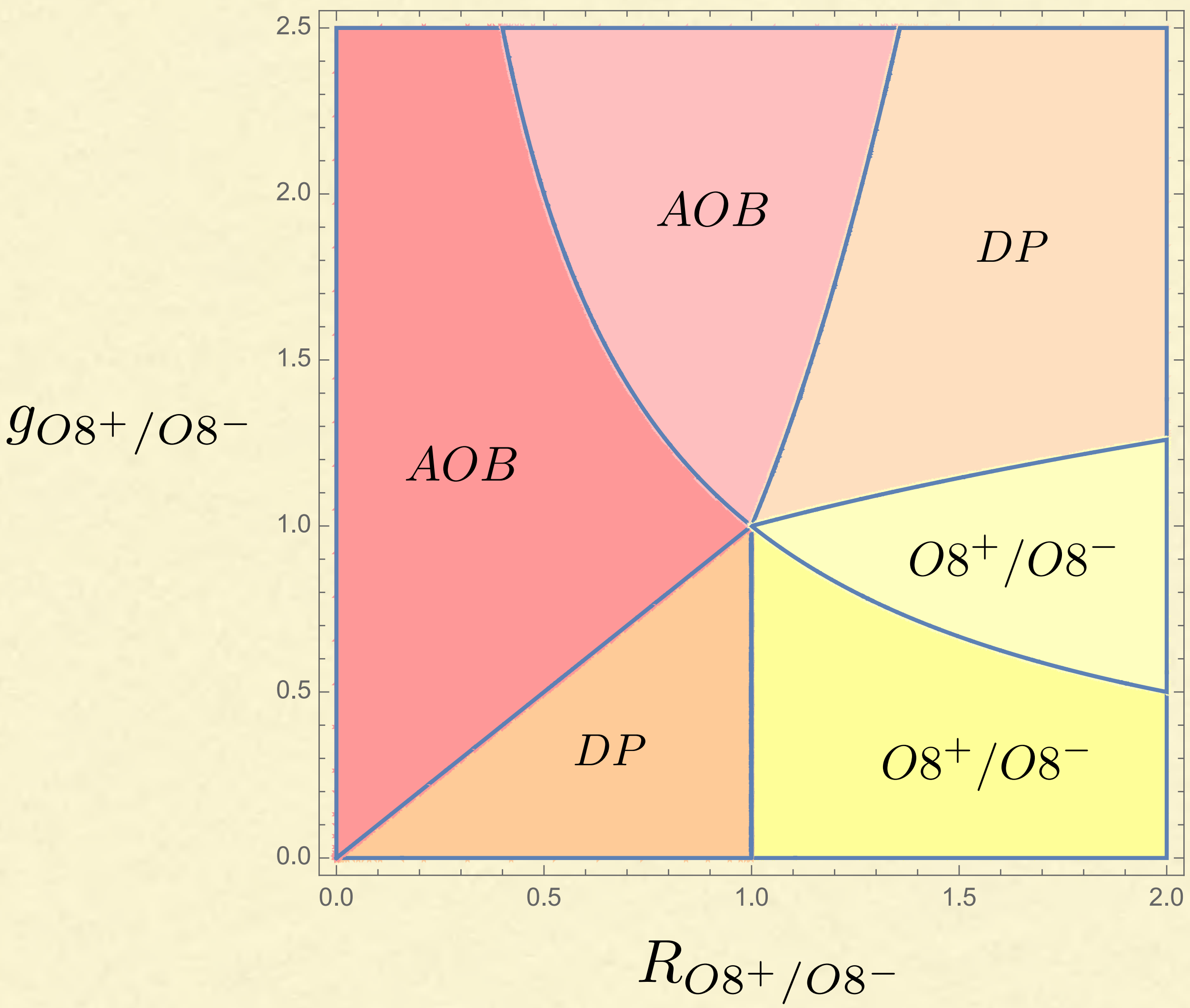
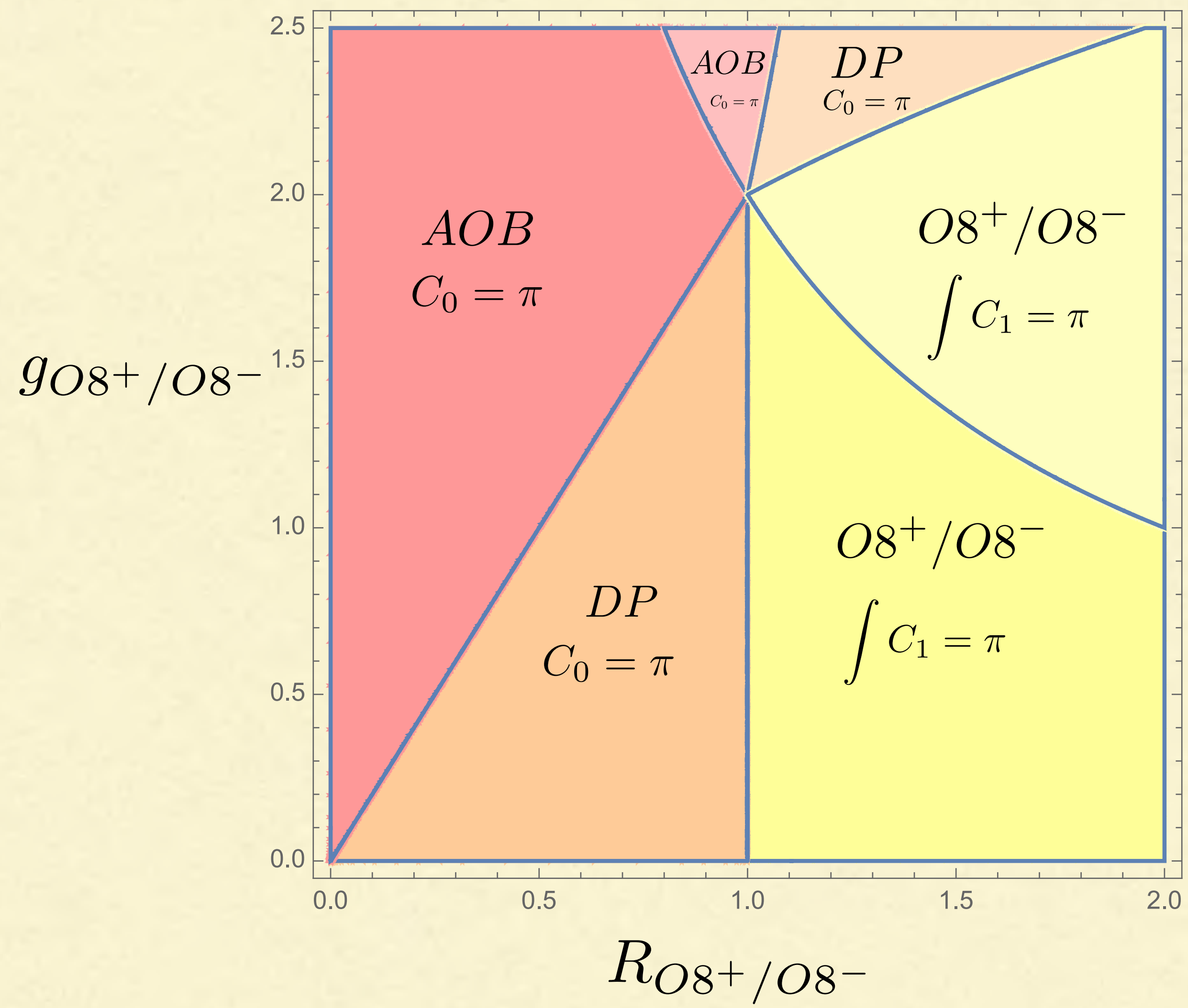
Many Swampland papers using anomaly inflow on strings in 6d, 10d assume this; these need to be revisited.

Completely identified the moduli space:

[Aharony-Komargodski-Patir '07]





Self-dual point at gs=1

Duality group: $SL(2,\mathbb{Z})$

Self-dual point at gs=2

Duality group: $\Gamma_0(2)$

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16 Q´s?

Riemann-flat

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Two of them admit discrete theta angles

$\int C_2, \quad \int B_2$

The periods of 2-forms can be frozen

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In both cases, the theta angle turns on an incomplete BPS spectrum.

So the Landscape of N=1 theories in d>6 looks like this…

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${}^{10}_{16}$Type I/het $SO(32)$

${}^{10}_{16}$ Het $E_8 \times E_8$

${}^{9}_{17}$Het on S^1

${}^{8}_{18}$Het on T^2

${}^{9}_{1}$M-theory on KB

${}^{9}_{1}$F-theory on KB$\times S^1$

${}^{8}_{2}$M/F on KB$\times S^1$

${}^{7}_{3}$ M/F on KB$\times T^2$

${}^{9}_{1}$F-theory on N_2^3

${}^{8}_{2}$ M/F on N_2^3

${}^{7}_{3}$ M/F on $N_2^3 \times S^1$

${}^{9}_{9}$CHL

${}^{8}_{10}$CHL on S^1

${}^{7}_{3,5,7,11,19}$Het. with triple

(6 components)

${}^{7}_{3}$IIB on O_2^3

(2 θ angles/ 3 components)

${}^{7}_{1}$ IIB on O_3^3

${}^{7}_{1}$ IIB on O_4^3

${}^{7}_{1}$ IIB on O_6^3

${}^{7}_{1}$ IIB on O_3^3

with θ ang.

${}^{7}_{1}$ IIB on O_4^3

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Dimension

Rank Theory

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Now I will describe what could be a **conjecture**

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But this is still **work in progress**,

and there might be counterexamples.

(if you know one, let me know!)

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Every example I know admits a geometric description now.

leading to…

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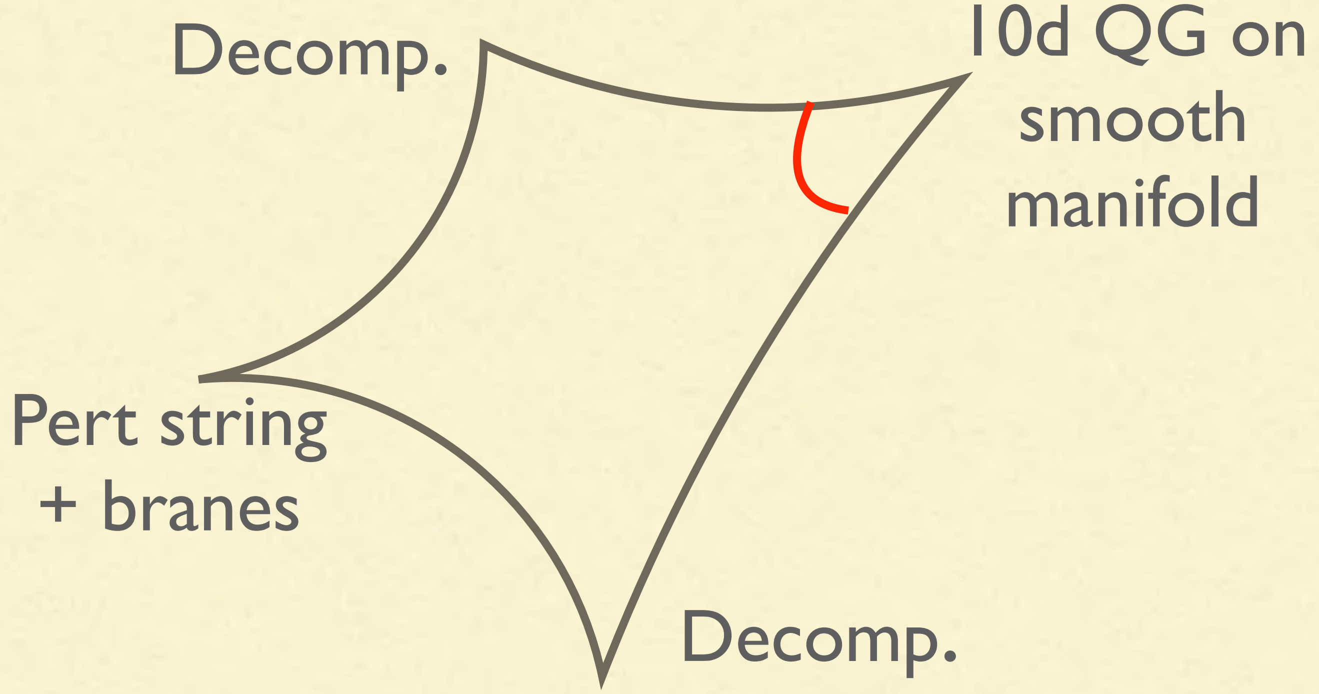

“Supergravity conjecture”

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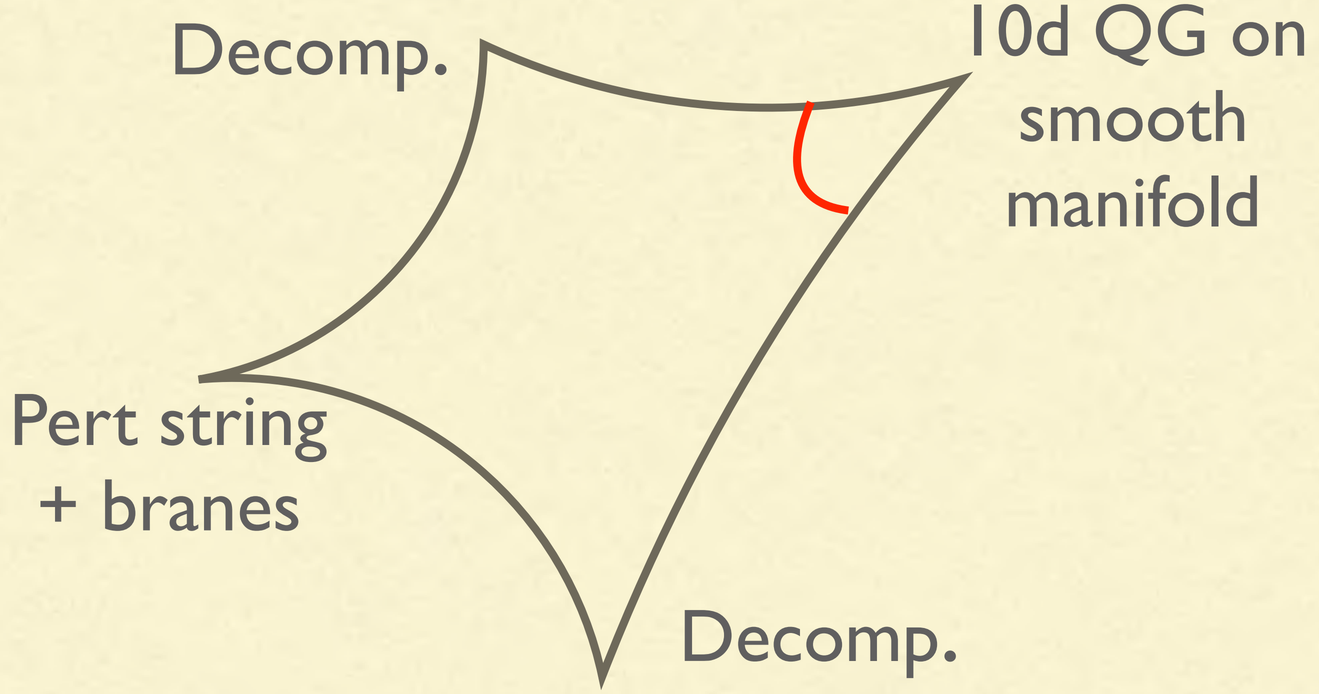
That means **no branes, no orientifolds, etc.**



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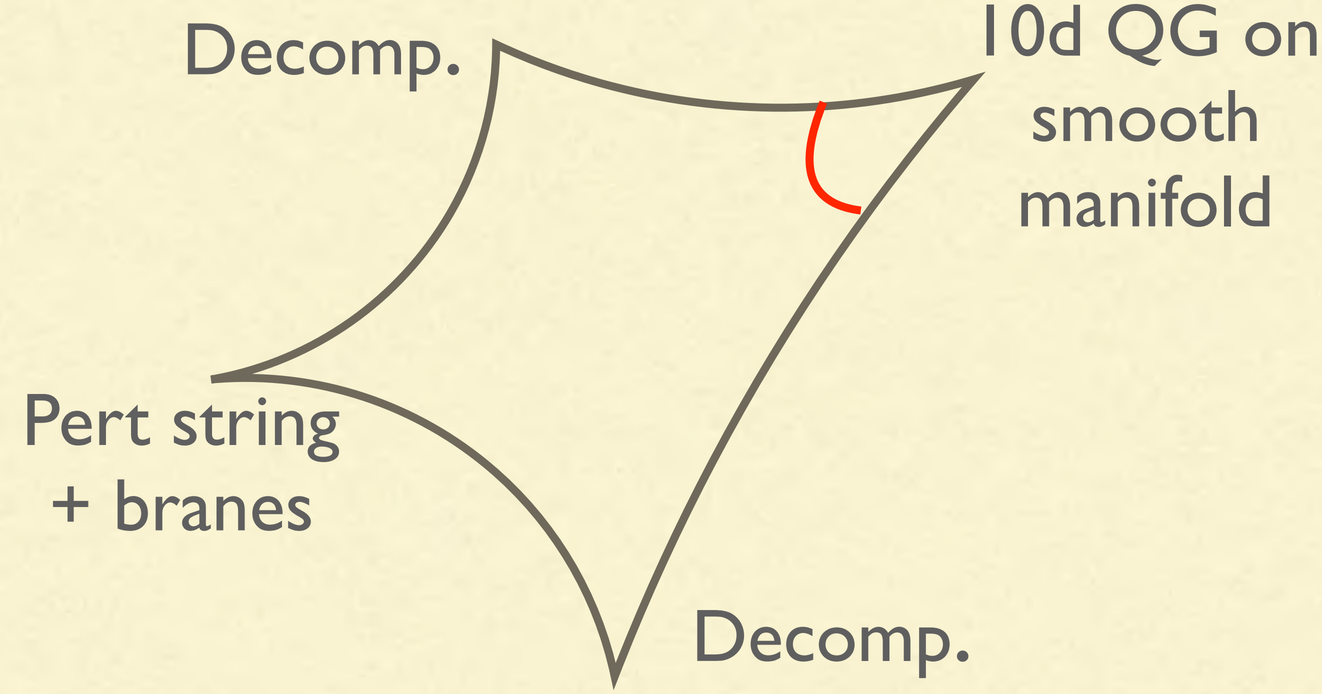

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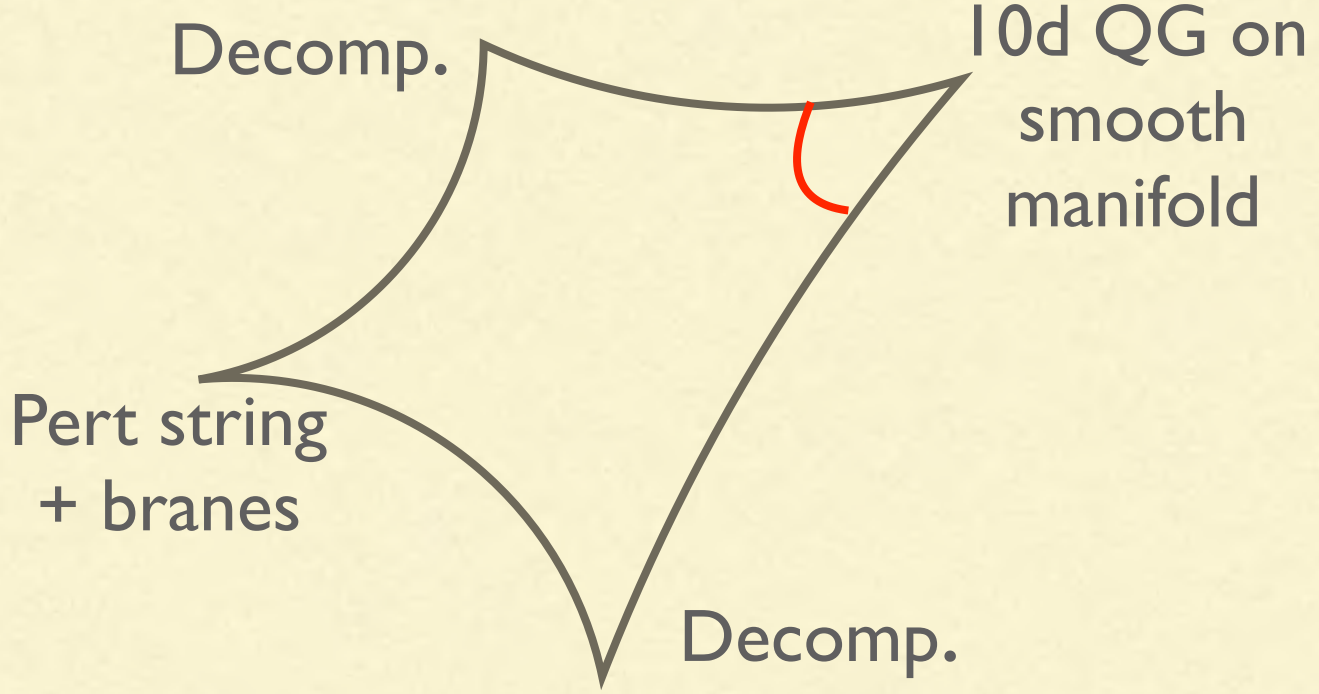

In a sense, SUGRA “has a peek” at everything!
(just a peek, though; at most a small corner of moduli space)

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(conjecture becomes more interesting with more Q´s)

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Applications/consequences?

Summary & future directions

- (At least) three new SUSY string theories in 9d,8d and 7d
- Some of the new models do not have a full lattice of BPS strings
- Find new low-rank examples using compactifications on Bieberbach manifolds
- Is the Supergravity conjecture correct? What would be its consequences?

¡Gracias!