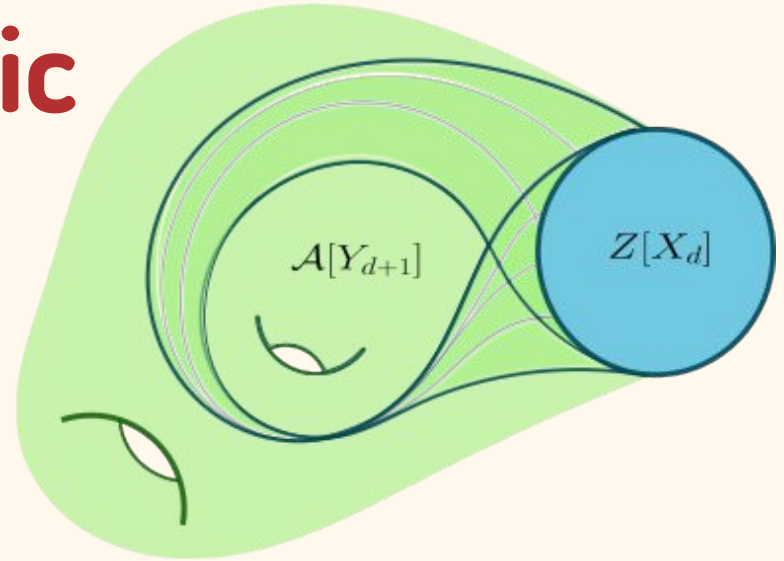


# Global Anomalies in Non-supersymmetric String Theories



Based on:

[230x.xxxxx] Ivano Basile, Arun Debray, M.D., Miguel Montero



# Big Picture:

**Our universe is non-supersymmetric (at least) at low energies**

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**We know surprisingly little about the 10d non-supersymmetric string theories**

**We don't even know if gauge anomalies cancel!!!**

# Gauge Anomalies 101

[Alvarez-Gaumé, Ginsparg '85]

A gauge **anomaly** is when the partition function is not gauge invariant:

$$Z[X_d] \implies \tilde{Z}[X_d] \neq Z[X_d]$$

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They come in two types: **local and global**

- **local anomalies** are the “*usual ones*” (n-gon diagrams with fermions in the loop)
  - associated to gauge transformations that can be ***continuously deformed to the identity***
  - cancelled by ***Green-Schwarz mechanism***

(and even in the non-susy strings this was checked !)

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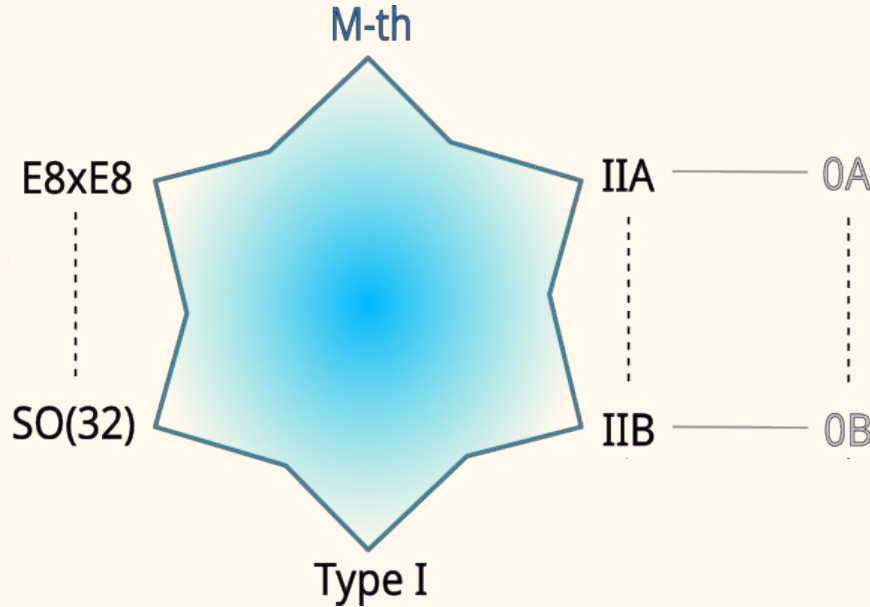
- **global anomalies** are associated to gauge transformations that **cannot be continuously deformed to the identity**

famous example: Witten's SU(2) anomaly '81



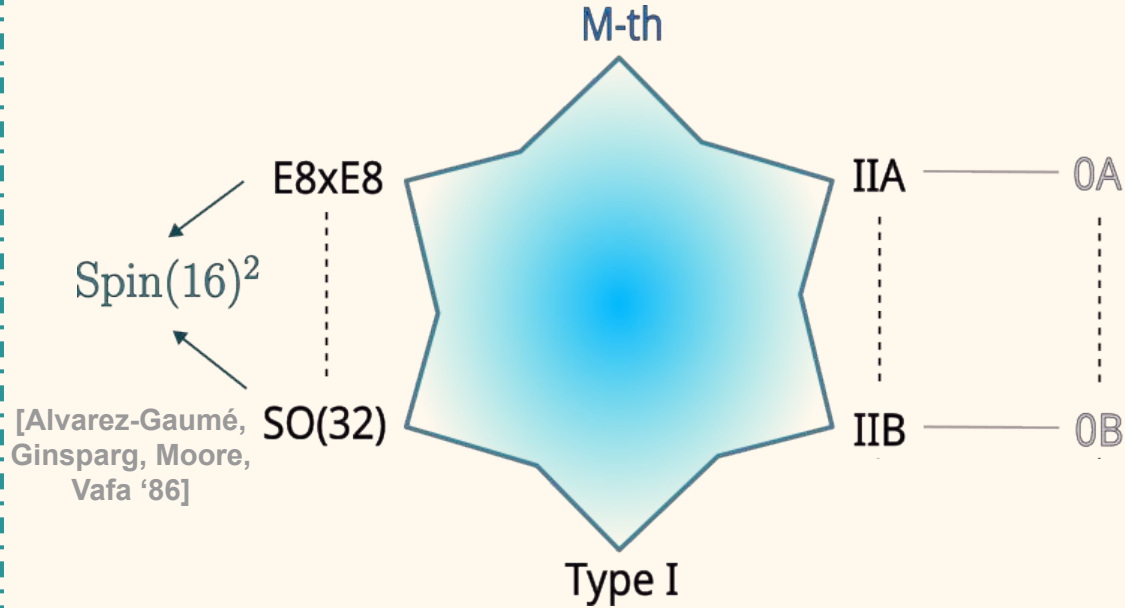
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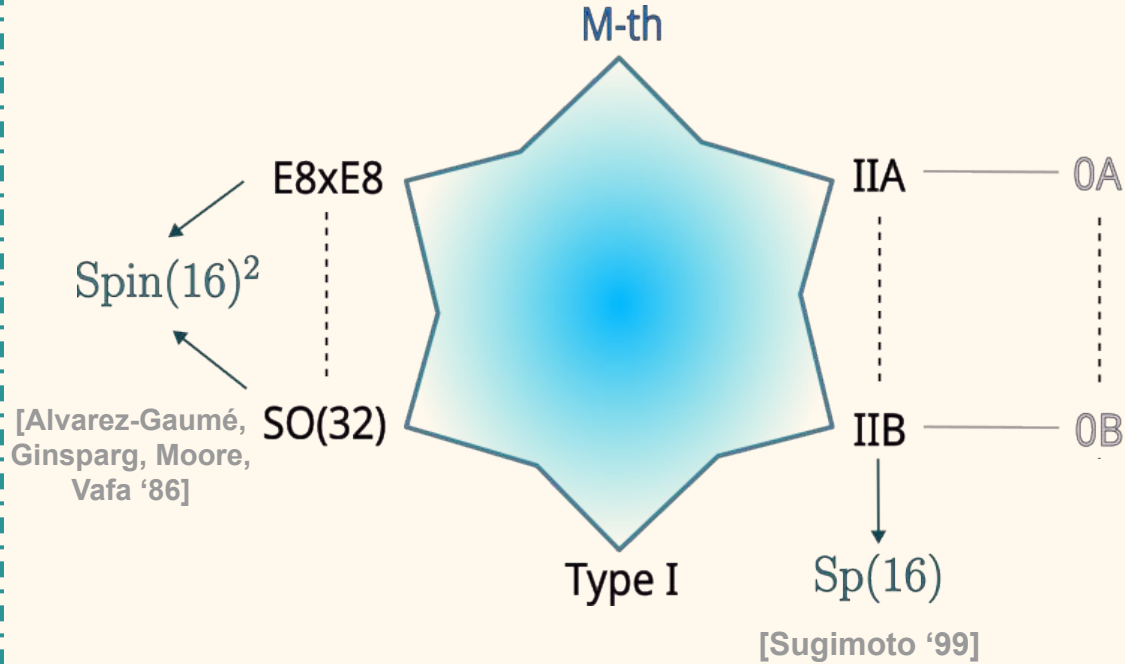
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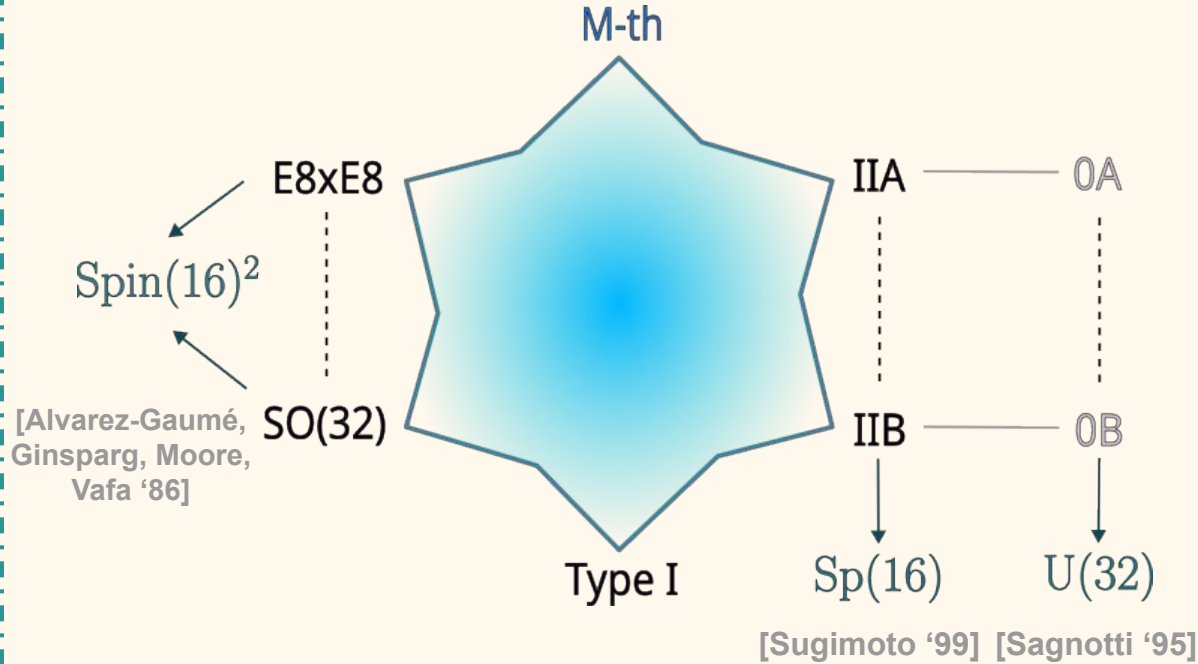
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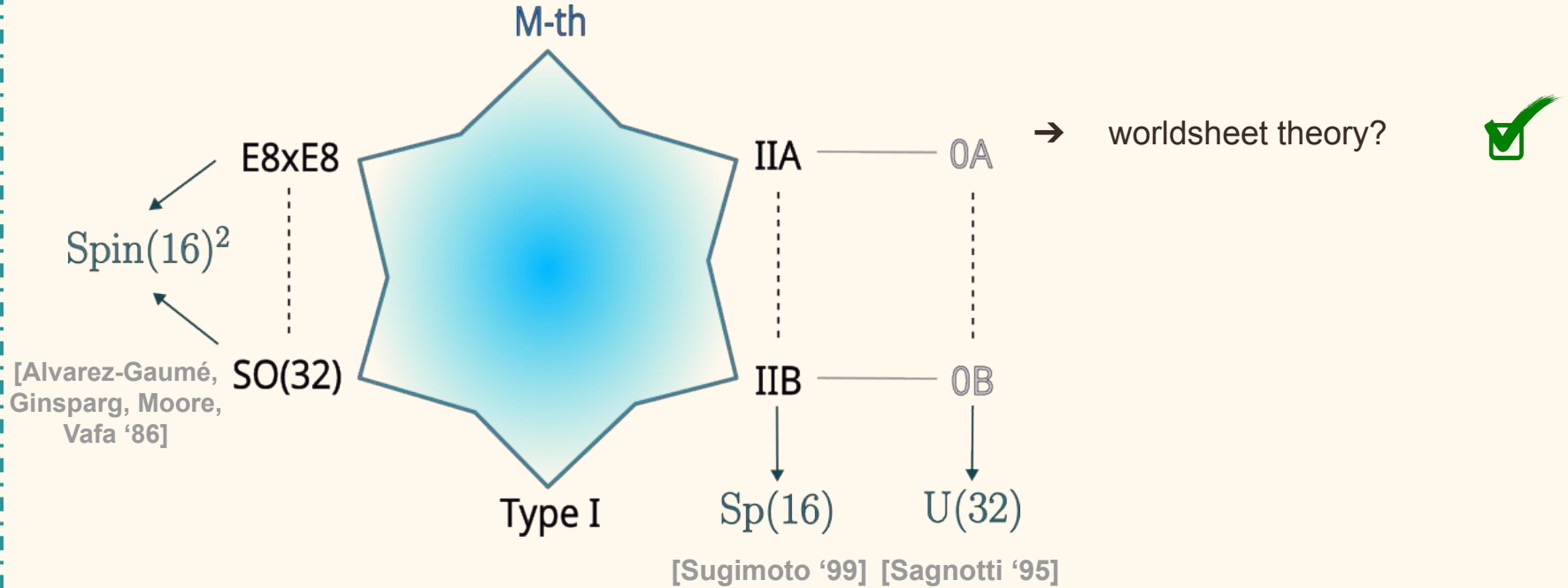
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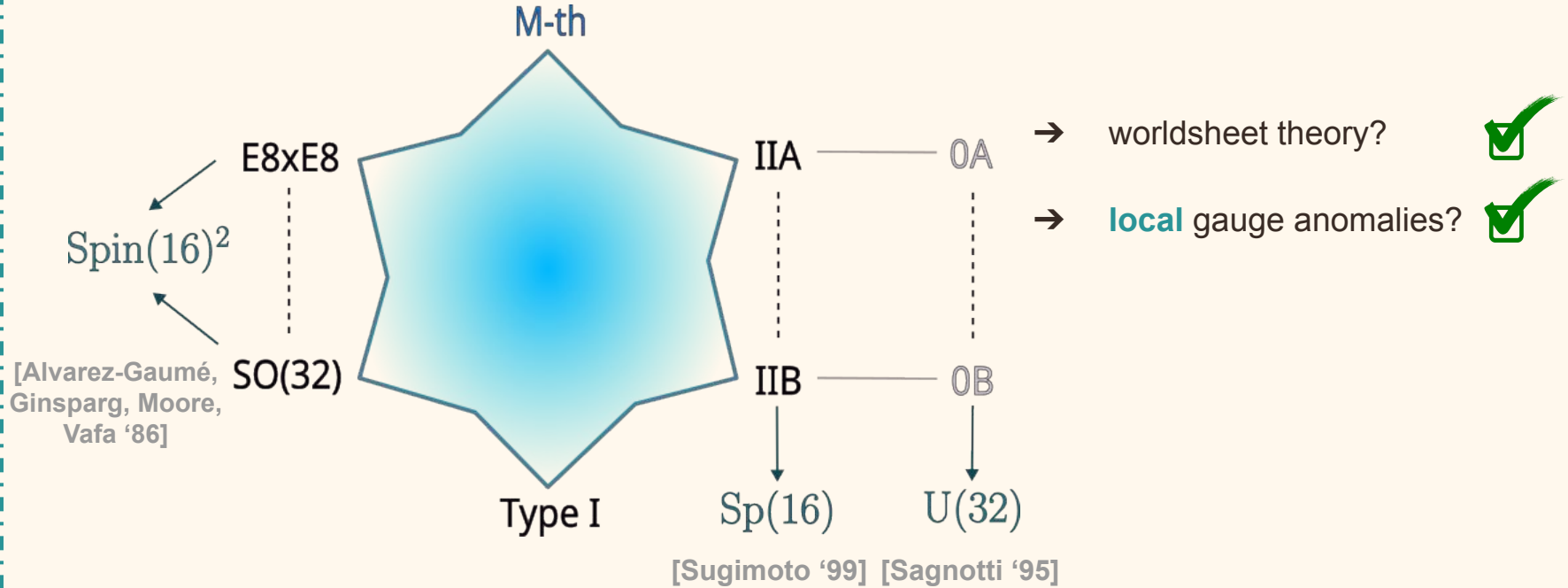
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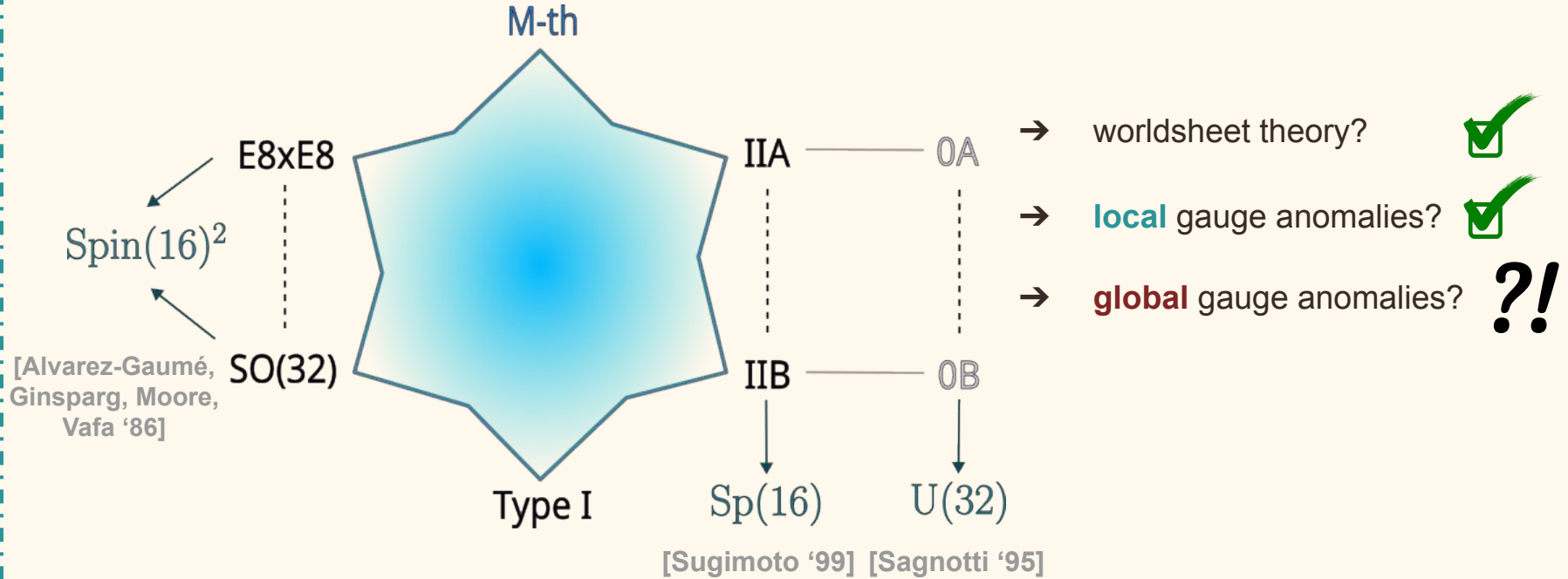
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# Global Anomalies: Modern formalism

The **anomaly theory** is an invertible  $(d+1)$ -dimensional field theory that is designed to give the **opposite anomaly** when integrated on  $Y_{d+1}$  such that  $\partial Y_{d+1} = X_d$ :

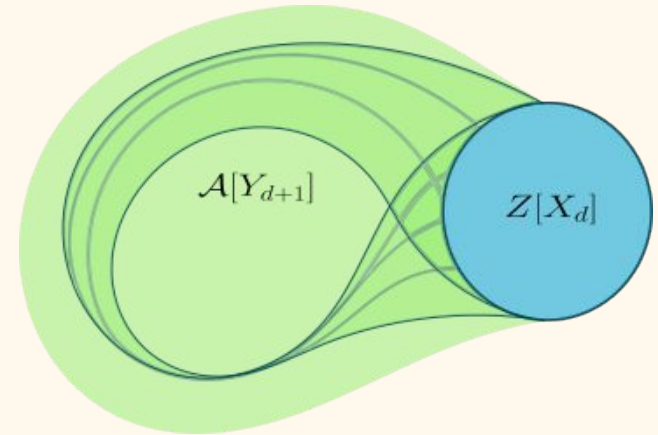
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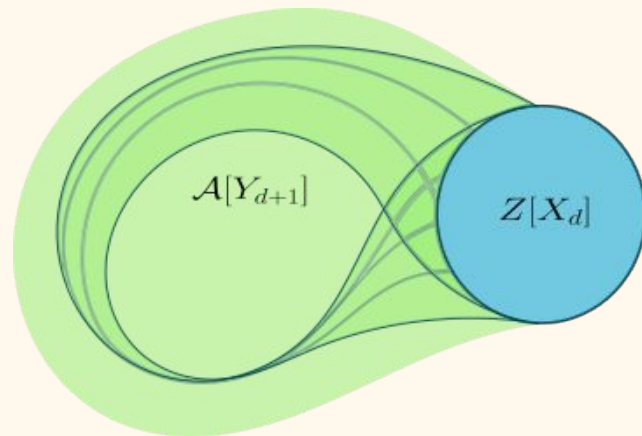


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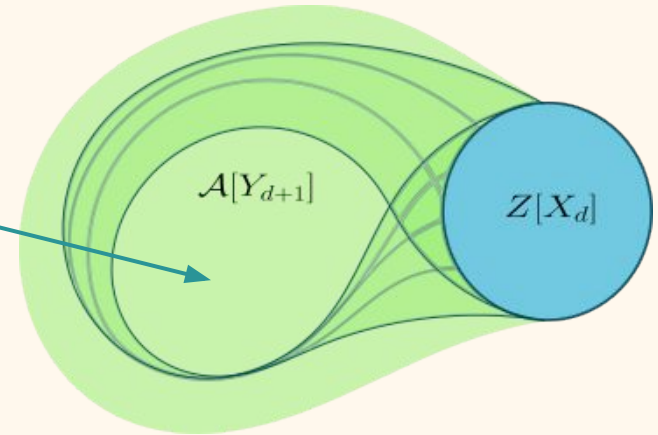
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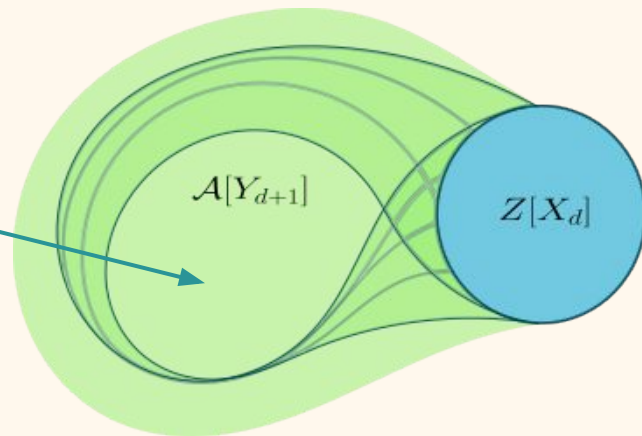
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for each anomalous DoF you  
associate a contribution to  $\mathcal{A}(Y_{d+1})$

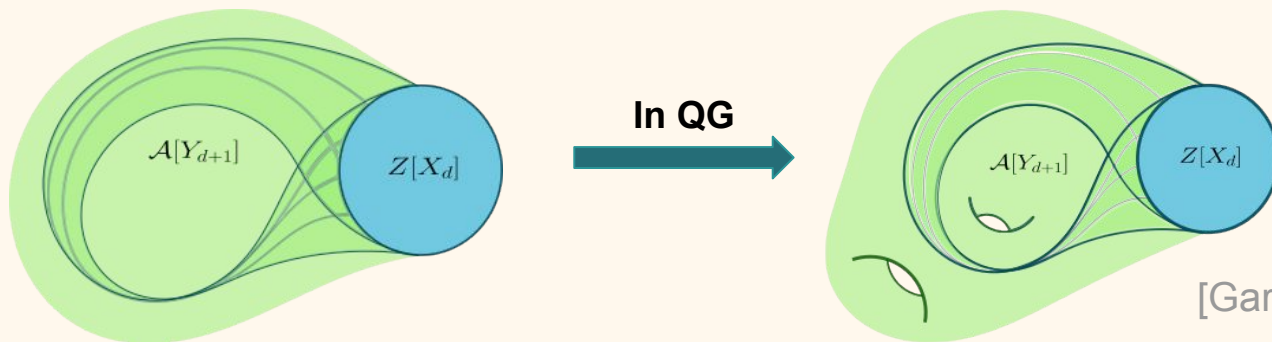


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In quantum gravity we expect topology changes to be allowed:

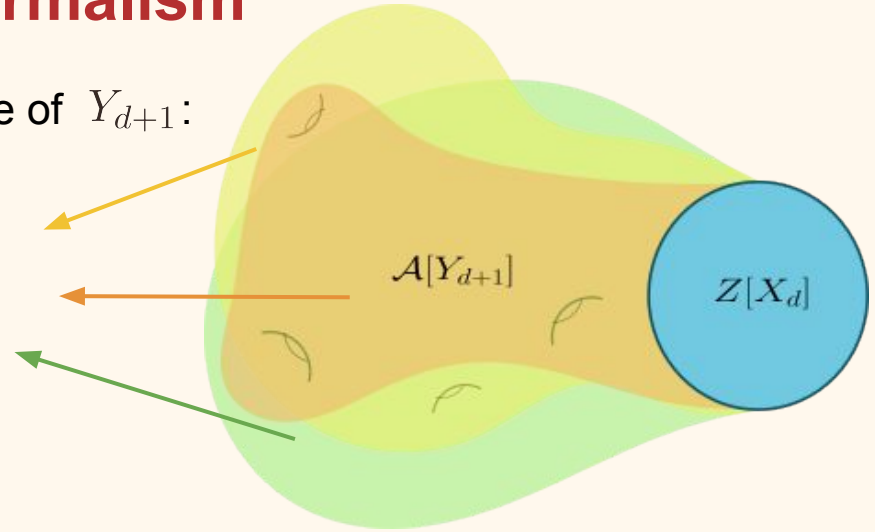


[García-Etxebarria,  
Montero '18]

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The anomaly **should not depend** on the choice of  $Y_{d+1}$ :

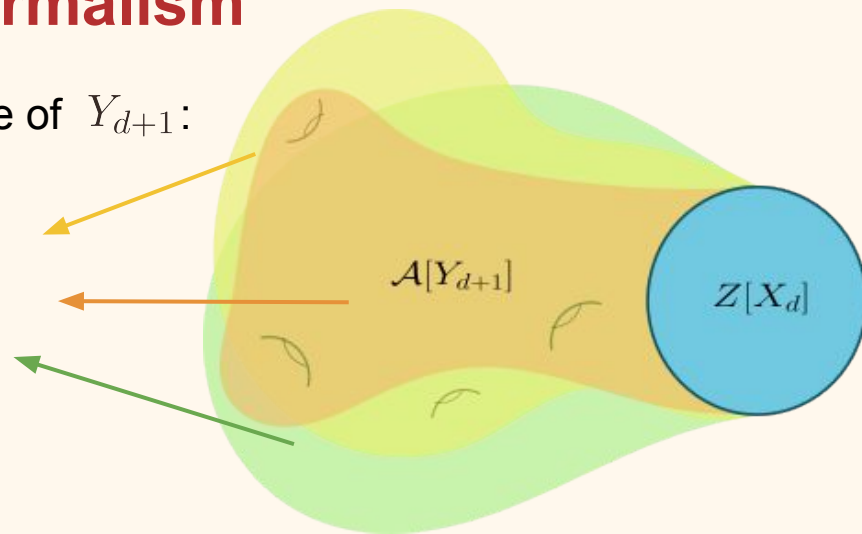
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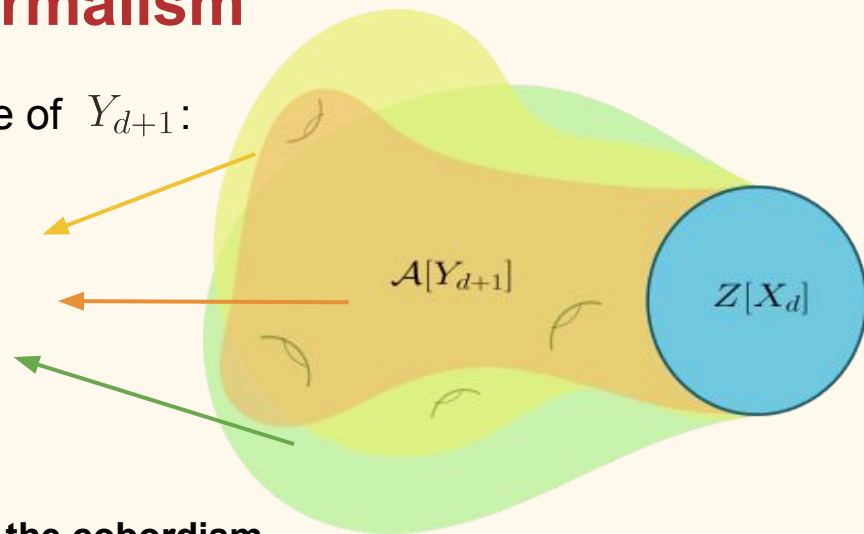
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**the same cobordism groups as in the context of the cobordism conjecture!**

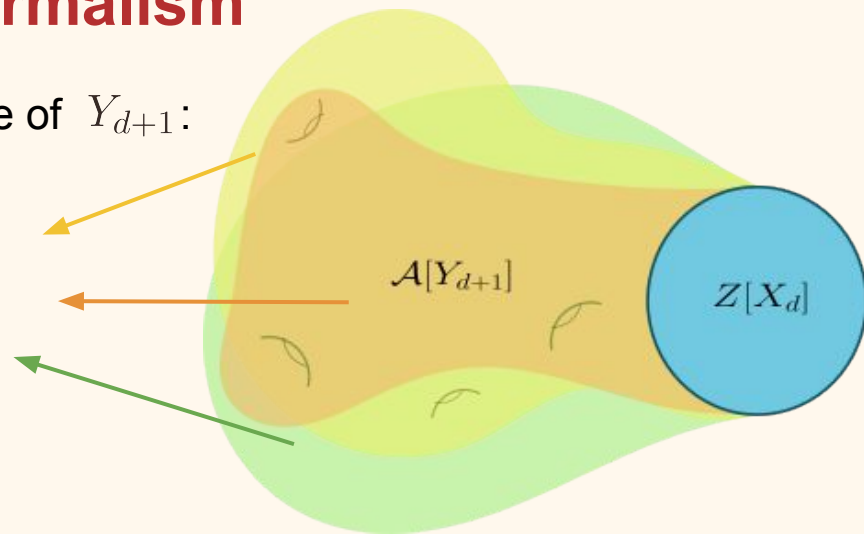
[Angius, Blumenhagen, Buratti, Cribiori, Calderon-Infante, DeBiaso, Debray, Delgado, Dierigl, Garcia-Etxebarria, Heckman, Huertas, Kneissl, Makridou, Montero, McNamara, Lust, Torres, Uranga, Vafa, Valenzuela, Velazquez, Wang... '19-'23]



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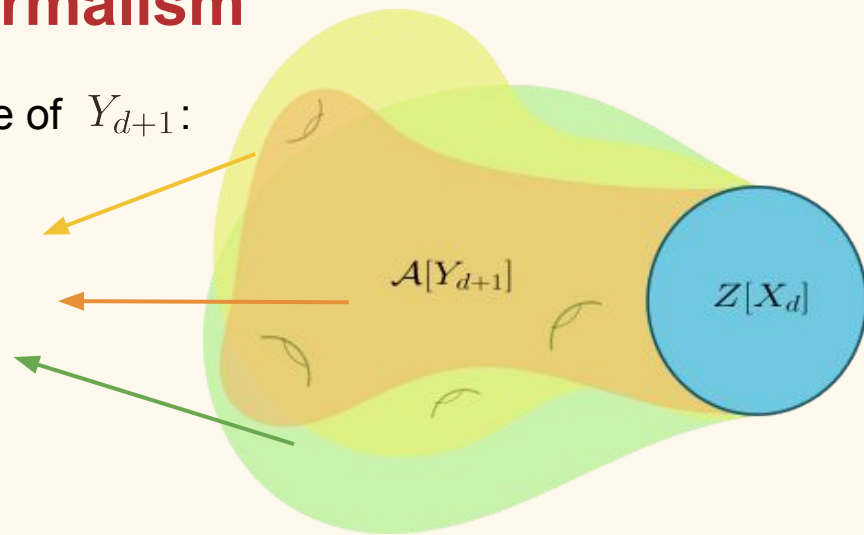
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**IF**  $\Omega_{d+1}^{\xi} = 0$  , **global anomalies vanish.**

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**Not many** of them are known, we computed

$$\Omega_{11}^{string-Sp(16)}, \quad \Omega_{11}^{string-Spin(16)^2}, \quad \Omega_{11}^{string-U(32)}$$

using the Adams spectral sequence.

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[Alvarez-Gaumé, Ginsparg, Moore, Vafa '86]

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non-susic analog of Type I  
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# Strings Breaking SUSY

November 22–23, 2023



<https://indico.mitp.uni-mainz.de/event/363>



## YOUNGST@RS - Strings Breaking SUSY



**Starts** Nov 22, 2023, 2:00 PM

**Ends** Nov 23, 2023, 5:30 PM

Europe/Berlin



Mainz Institute for Theoretical Physics, Johannes  
Gutenberg University

Virtual Workshop



**Organized by Ivano Basile (LMU), Niccolò Criblori (MPI Munich), Matilda Delgado (IFT UAM-CSIC) and Flavio Tonloni (UW Madison).**

**Thanks!**