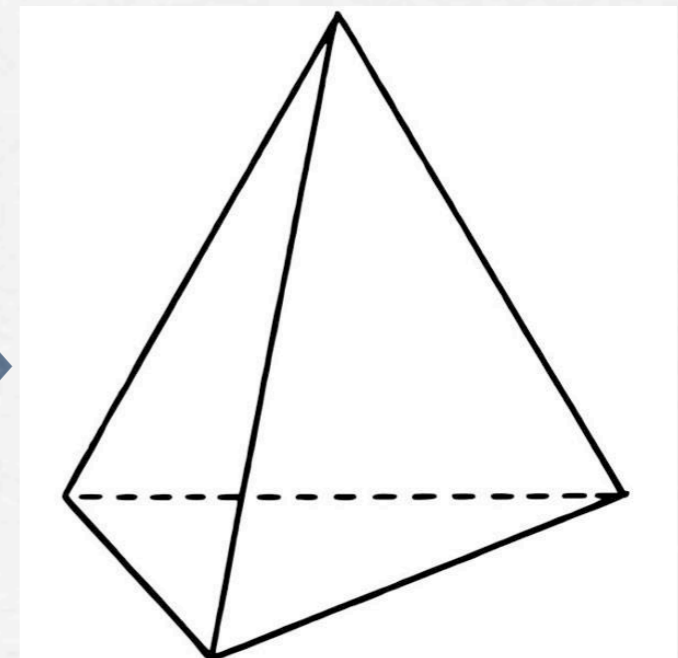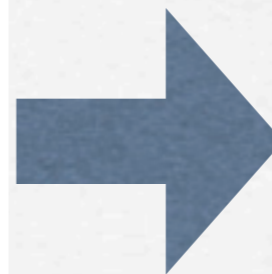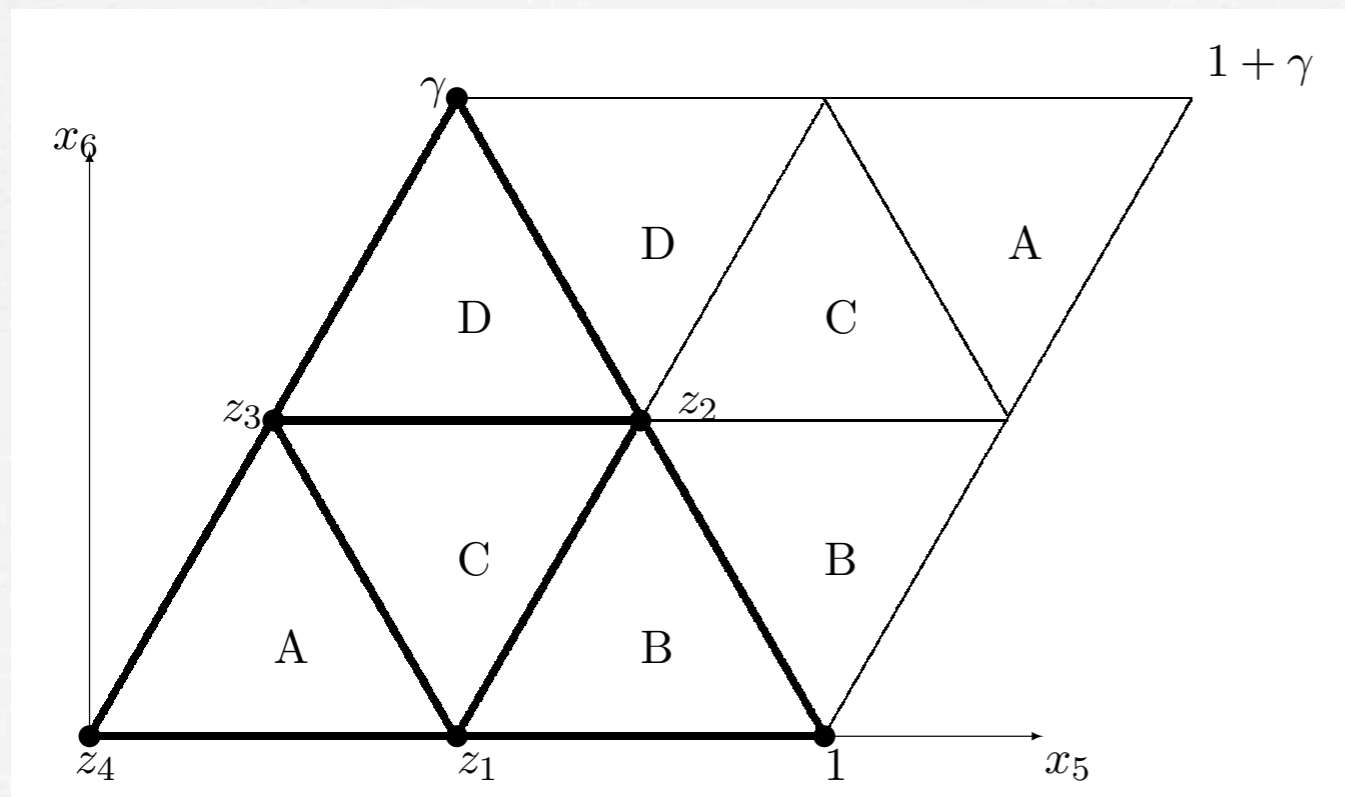# What is the origin of discrete flavour symmetry?

- ☐ Broken gauge symmetry?

- ☐ Extra dimensions?

- ☐ String theory?

- ☐ ...?

Broken gauge theory

☐ Start with a continuous gauge group e.g. SU(3)

☐ Then break to "discrete gauge symmetry" using Higgs in large reps of SU(3)

☐ E.g. Luhn https://arxiv.org/pdf/1101.2417.pdf

finite subgroup $\mathcal{G}$	**3**	**6**	**8**	**10**	**15**	**15′**	**21**	**24**	**27**
$\mathcal{A}_4 = \Delta(12)$	−	1	−	1	1	2	1	2	3
$\Delta(27)$	−	−	−	2	−	−	−	−	3
$\mathcal{S}_4 = \Delta(24)$	−	1	−	−	−	2	−	1	2
$\Delta(54)$	−	−	−	−	−	−	−	−	3

Extra dimensions

- E.g. Altarelli, Feruglio, Lin
  https://arxiv.org/abs/hep-ph/0610165

- 6-d compactified into a torus on an orbifold T^2/Z_2 a gives A4 tetrahedral symmetry

Figure 2.4: The Orbifold $\mathbb{T}^2/\mathbb{Z}_2$. The fundamental domain is outlined in bold and forms a tetrahedron. Regions labelled by A,B,C and D are identified. The fixed points are labelled z_i and are symmetrically permuted under the symmetry group A_4.

theory

o-d with 6-d orbifolds: D4, Delta 54

...oger, Raby , Ratz

.../hep-ph/0611020.pdf

☐ F-theory models may also have non-Abelian discrete family symmetry, specifically S4 and its subgroups

☐ Antoniadis, Leontaris https://arxiv.org/pdf/1308.1581.pdf

equations (2.6.3),(2.6.1),(2.6.2). The orbifold can be described as a regular
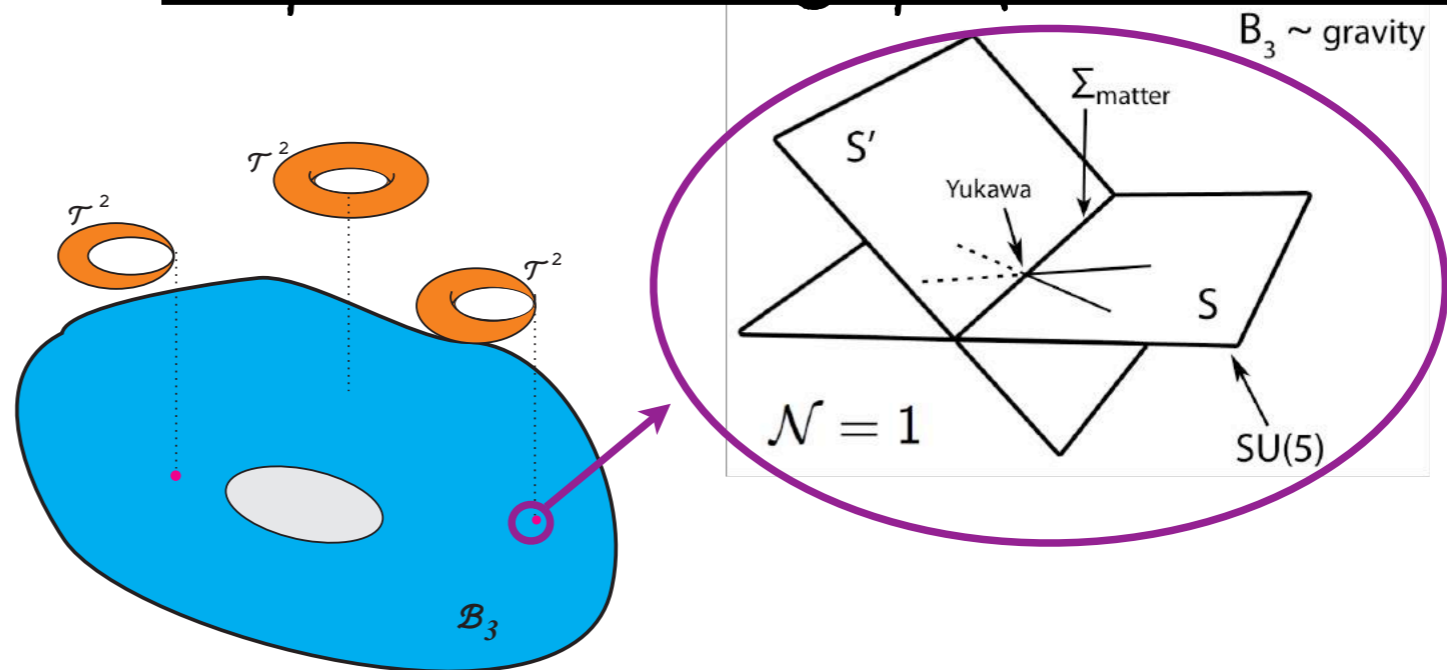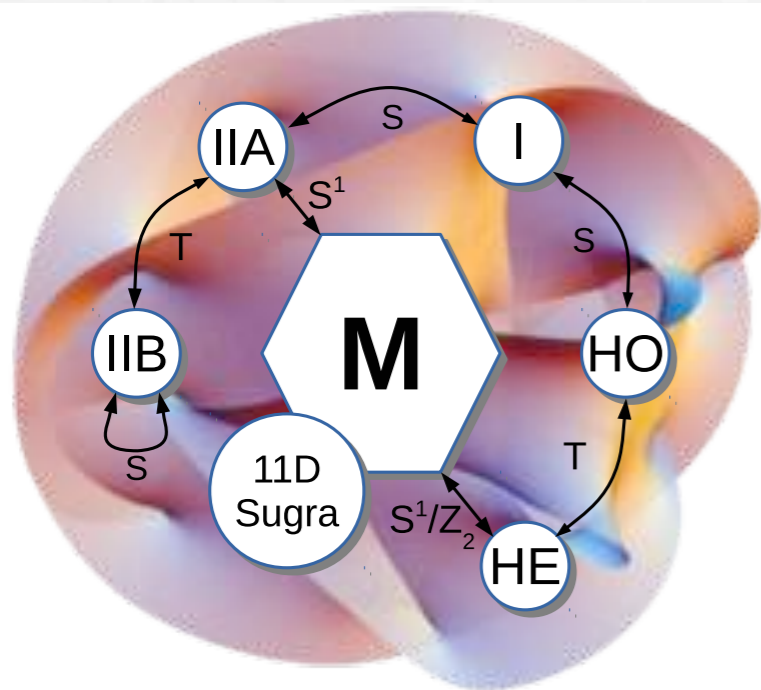
☐   6-d SO(10)xS4 Adulpravitchai, Schmidt

https://arxiv.org/pdf/1001.3172.pdf

☐   6-d and 8-d SU(5)xA4 Burrows et al

https://arxiv.org/abs/0909.1433

http://arxiv.org/abs/arXiv:1007.2310

☐   Discrete flavour symmetries in D-brane models

Marchesano, Regalado, Vazquez-Mercado
https://arxiv.org/pdf/1306.1284.pdf

☐   10-d SYM with magnetised fluxes

Abe, Kobayashi, Ohki, Sumita, Tatsuta
https://arxiv.org/pdf/1404.0137.pdf