Deformed supersymmetric gauge theories from String and M-Theory

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based on work with with D. Orlando, S. Hellerman, N. Lambert
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In recent years, N=2 supersymmetric gauge theories and their deformations have played an important role in theoretical physics - very active research topic.
Examples:

2d gauge/Bethe correspondence (Nekrasov/Shatashvili): relates 2d gauge theories with twisted masses to integrable spin chains.

4d gauge/Bethe correspondence (Nekrasov/Shatashvili): relates Omega-deformed 4d gauge theories to quantum integrable systems.

AGT correspondence (Alday, Gaiotto, Tachikawa): relates Omega-deformed super-Yang-Mills theory to Liouville theory.

All these examples have two things in common:

1. A deformed supersymmetric gauge theory is linked to an integrable system.

   Relation between two very constrained and well-behaved systems that can be studied separately with different methods.

   Transfer insights from one side to the other, cross-fertilization between subjects!

2. The deformed gauge theories in question can be realized in string theory via the fluxtrap background!

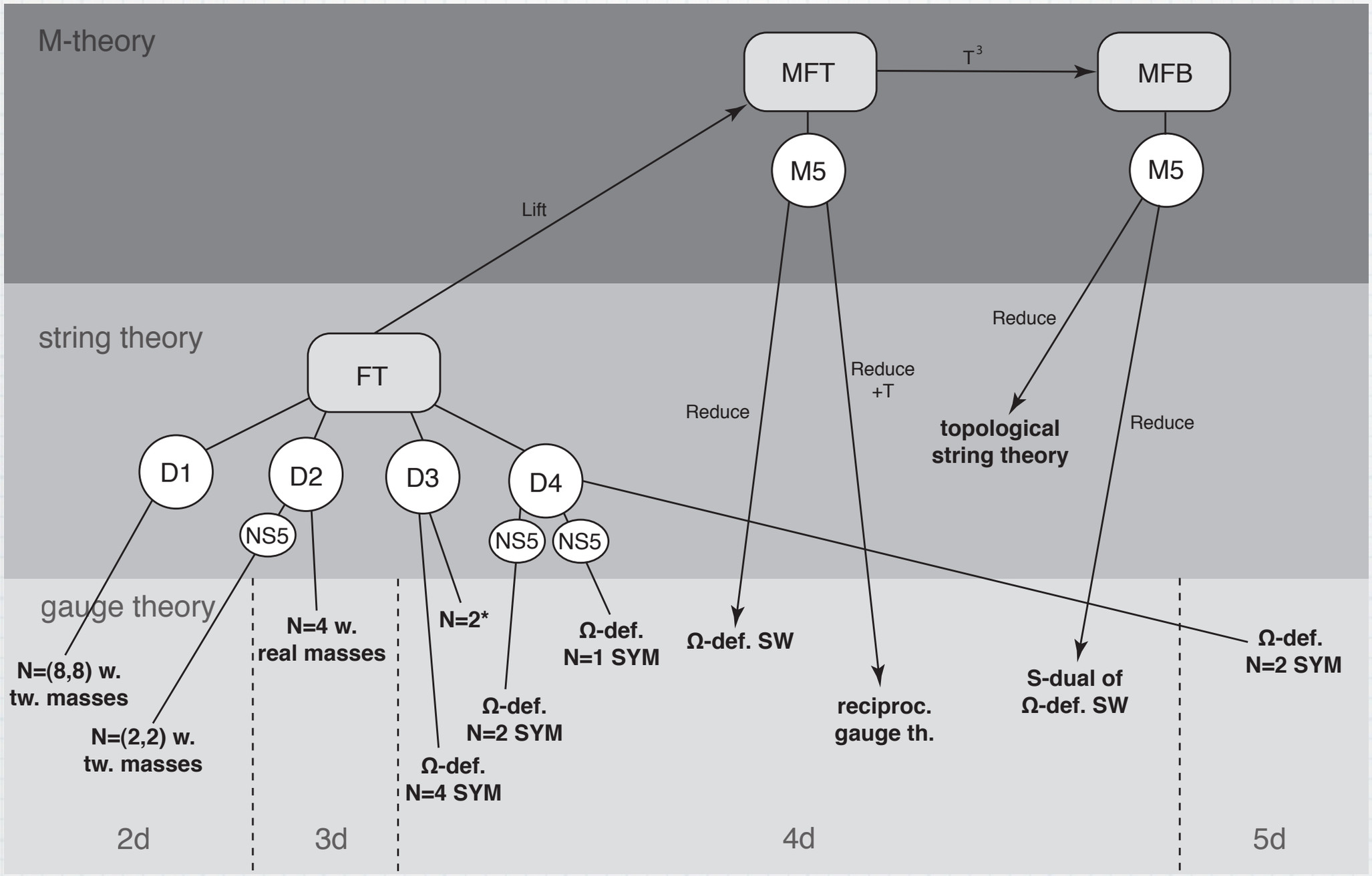
   The string theory construction provides a unifying framework and a different point of view on the gauge theory problems.

Realize deformed supersymmetric gauge theories via string theory. Gauge theories encode fluctuations on the world-volume of D-branes. Many parameters can be tuned by varying brane geometry.

Here: Deform the string theory background ("fluxtrap") into which the branes are placed (Hellerman, Orlando, S.R.)

$\Rightarrow$ different brane set-ups give rise to different gauge theories with seemingly unrelated deformations!

Use the fluxtrap construction to unify and meaningfully relate and reinterpret a large variety of existing results.



The same string theory background can give rise to many different deformations depending on how we place branes in it!

The type of deformation resulting from the fluxbrane background depends on how D-branes are placed into the fluxtrap with respect to the monodromies:

Deformation not on brane world-volume: mass deformation

fluxtrap				ϵ_i		ϵ_j
D–brane	$\times$	$\times$	$\times$	ϕ_i		

Deformation on brane world-volume: Ω-type deformation, Lorentz invariance broken

fluxtrap		ϵ_i			ϵ_j	
D–brane	$\times$	$\times$	$\times$	$\times$		