Little M-theory

JESSE THALER

H-C Cheng
L-T Wang
JKT

little ⇒ composite Higgs

M-theory ⇒ unified frameworks

LHC unified frameworks: MSSM

GMSB
AMSB
Mirage
Split

⇒ MSSM-theory

NMSSM

Z'SSM

Different
Messenger
Mechanism

⇒ BSSM-thy

MSSM: $m_{\tilde{g}}$ $m_{\tilde{q}}$ μ $B\mu$ ---

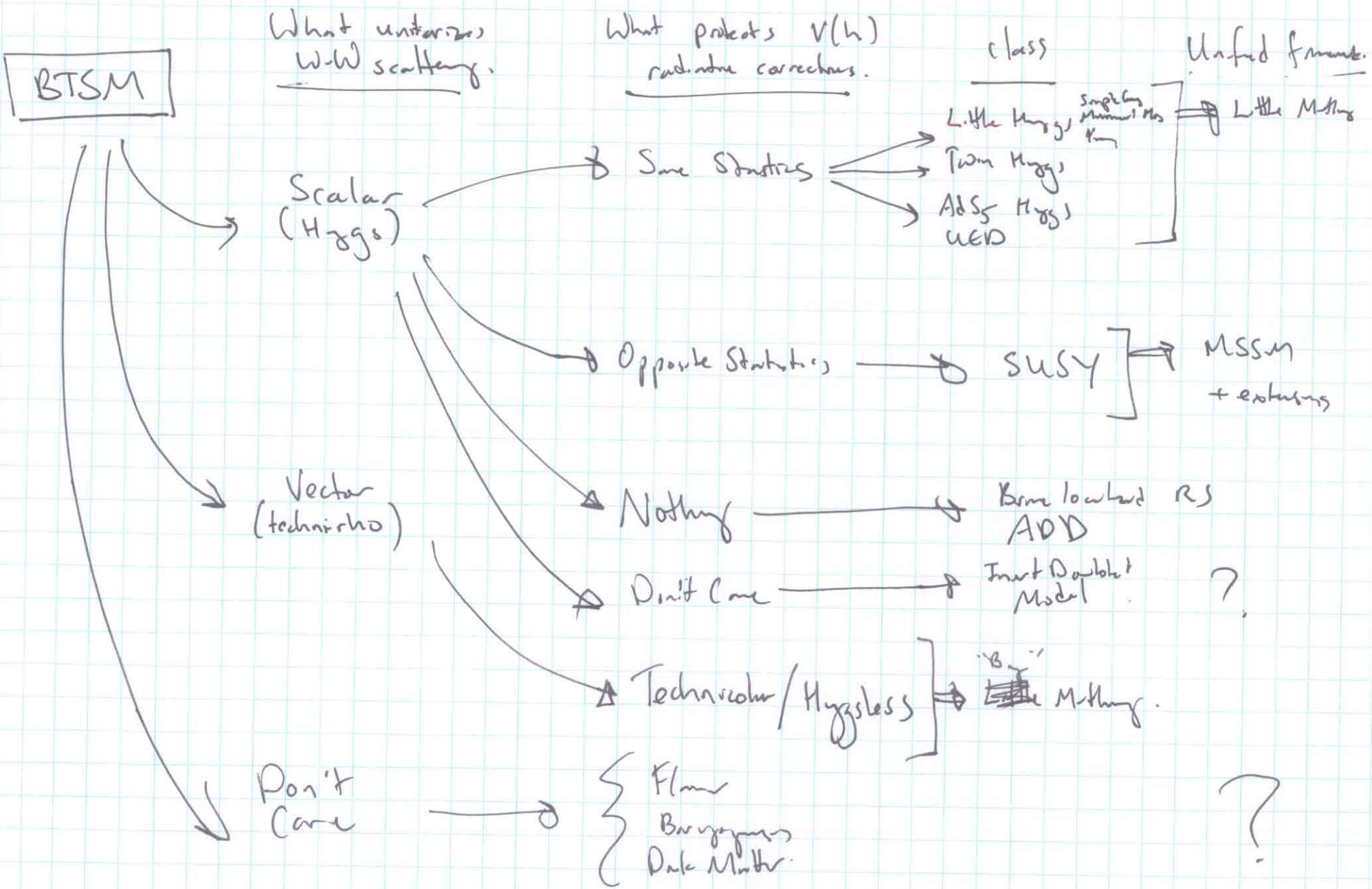
Composite Higgs:

Simple Group
Minimal Moose
Little Higgs
AdS$_5$ { w / w/o } SU(2)$_c$
Anti-Sym Cond.

⇒ Little M-theory

Different
Gauge
Structure

⇒ Little M-theory.


BTSM
What unitarizes W-W scattering.
What protects V(h) radiative corrections.
class
Unified framework
Scalar (Higgs)
Some Symmetries
Little Higgs, Simplest Little Higgs
Twin Higgs
AdS5 Higgs
UED
Little Models
Opposite Statistics
SUSY
MSSM + extensions
Vector (technirho)
Nothing
Bare localized RS ADD
Don't Care
Inert Doublet Model
?
Technicolor / Higgsless
Nothing.
Don't Care
Flavor
Baryogenesis
Dark Matter
?

How is this possible?

Theoretical Fact

Decouple
- extra-dimensions
- Well approx extra dim AdS/CFT

moose

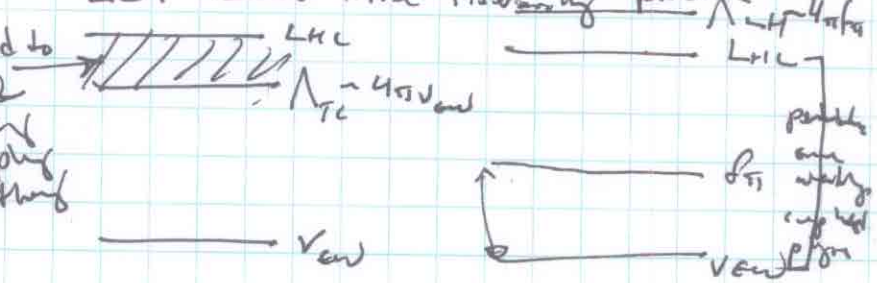
Well approx by moose LT (Holographic dual) hard to have strong coupling

Experimental Fact

LHC 14 TeV

$\frac{v_{EW}}{f_\pi} \sim 1/3$

LEP → little Hierarchy problem



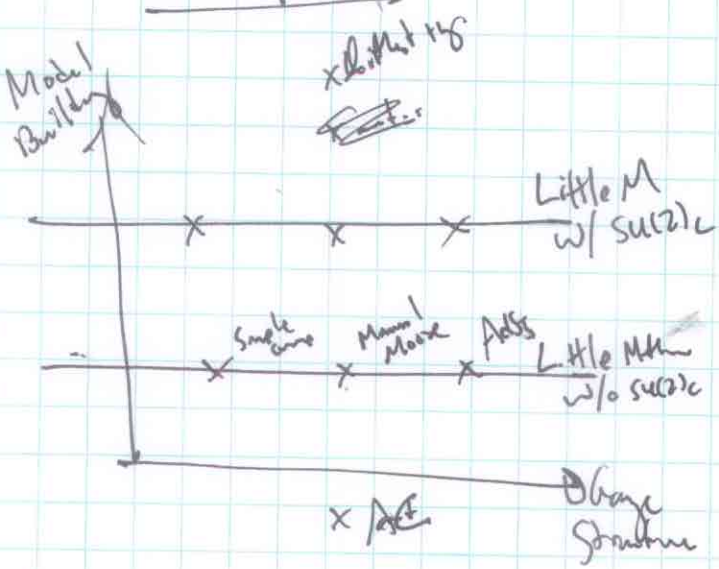
ALL MOOSES

Technical

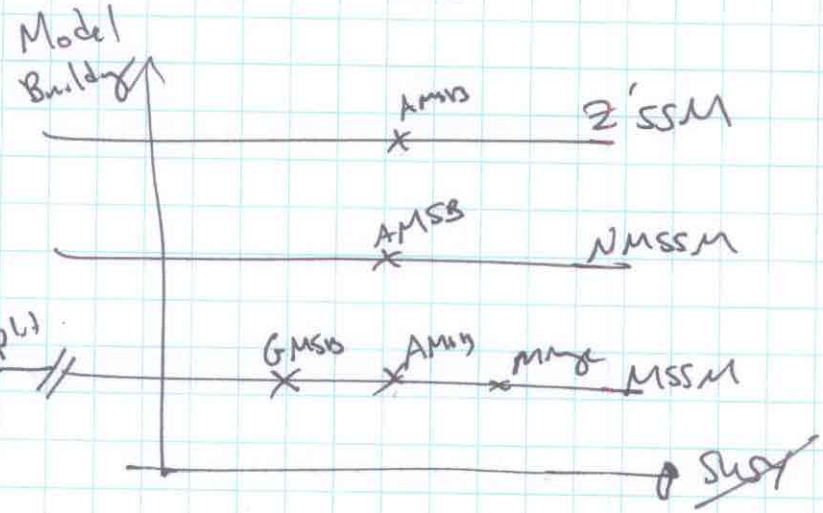
Composite

Pick in your mind

Composite



SUSY



How Does this work?

Simple Group $SU(3)_V \subset \left(SU(3)/SU(2)\right)^2$

10 gb 5 eaten XY ~~5 massless gb~~ 5 massive gb $SU(2)_L$ unbroken

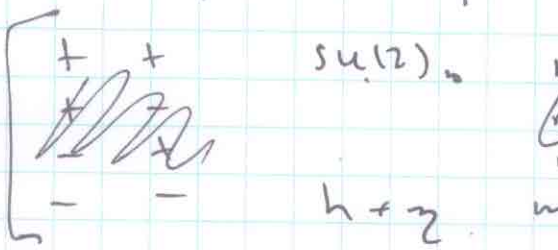
$h + \eta$

Minimal Moose

$SU(3) \times SU(3) \to V$

8 gb 3 eaten W' 5 massive $h+\eta$ $SU(2)_V$ unbroken

Original $SU(2)$ AdS_5 $SU(3)$ $H_{\eta\gamma\gamma}$ $SU(2)$



zero mode

$SU(2)_V$ massless vector ~~massive vector~~ ~~massive vector~~ massless scalar

$h + \eta$

KK. Full $SU(3)$ massive vector.

XY W'

Composite Higgs

$G/H \to H$ doublet

$G \supset SU(2)_L$

$SU(3)/SU(2) \to 3$ ——— 8

$\Phi = e^{i\pi} \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix}$

$\pi = \left(\begin{array}{cc|c} & ? & \\ & \eta & h \\ \hline & h^* & -2\eta \end{array}\right)$

turn on $SU(2)_L$

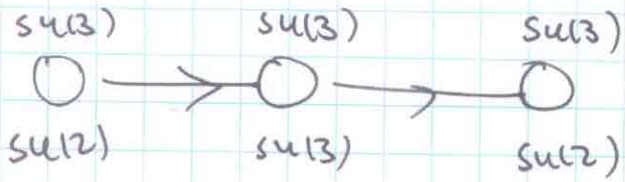
$V(e^{i\pi}) \sim \Lambda^2 \, tr(M^2)$

generally $v_{EW} \sim f_\pi$

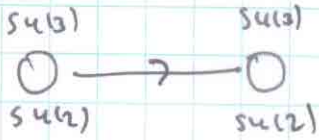
so just technicolor

Same light degrees of freedom.

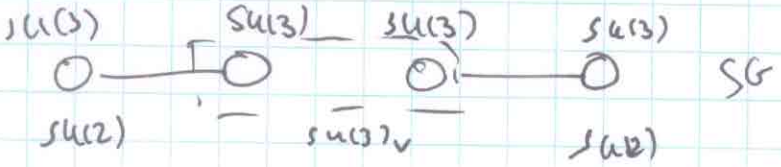
XY vs W' vs both



Adj_5

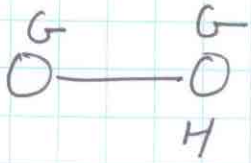


MM



SG

HLS / LT



$\Rightarrow G/H \quad g_{H} \to \infty$

$SU(3)_V \subset \left(SU(3)/SU(2) \right)^2$

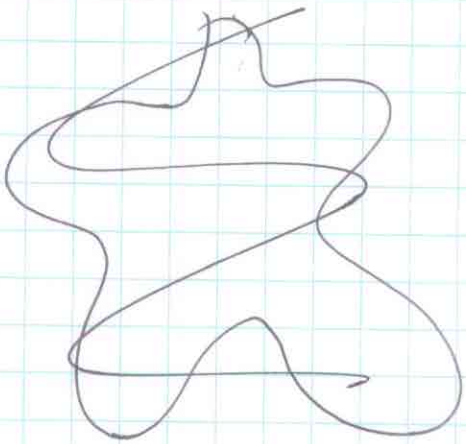
$g_1 \; g_m \; g_2 \; f_1 \; f_2$

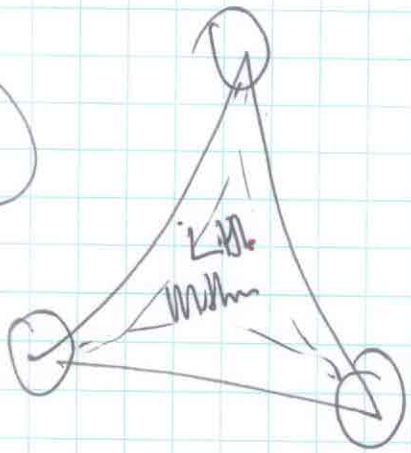
$\left(m_{\tilde{g}}, \mu, B_\mu \ldots \right)$

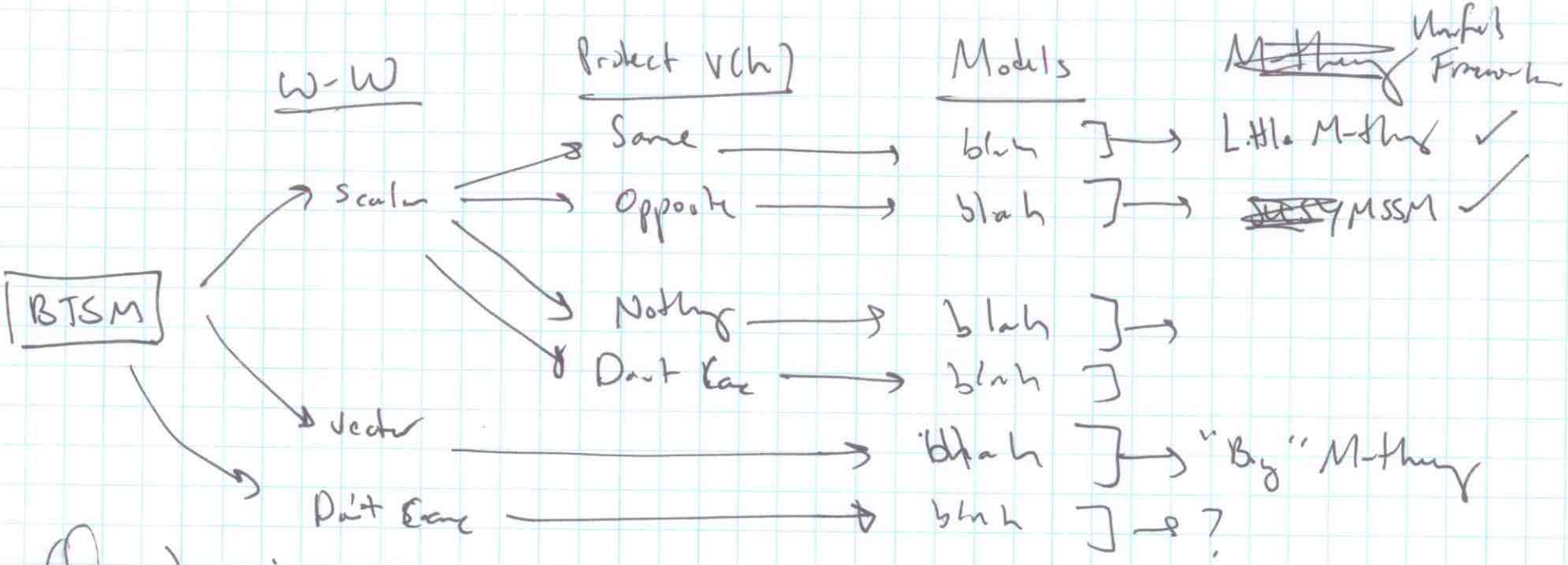
hep-ph/0607205 ⟹

Complete Model

hypercharge
fermions,
SU(2),
minimal flavor violation
minimal susy violation
lots of details
anomaly-free
T-parity limit







Questions:

Why M-theories at all? Why not just bottom-up?

Is M-thy too big? Too small?

Benchmarks? Black boxes?

Why M-thy at all? Why not top down?