EMPG SEMINAR
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Linear Sigma Models for Heterotic Vacua

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with D. Morrison 1103.1322.
I. Melnikov 1004.5447
R Plesser 1001.2104
M Kreuzer. 0010:0012.
S Seth. 0712.3272.

Review: 1010.4667.

use ST to study apps of het. stg.

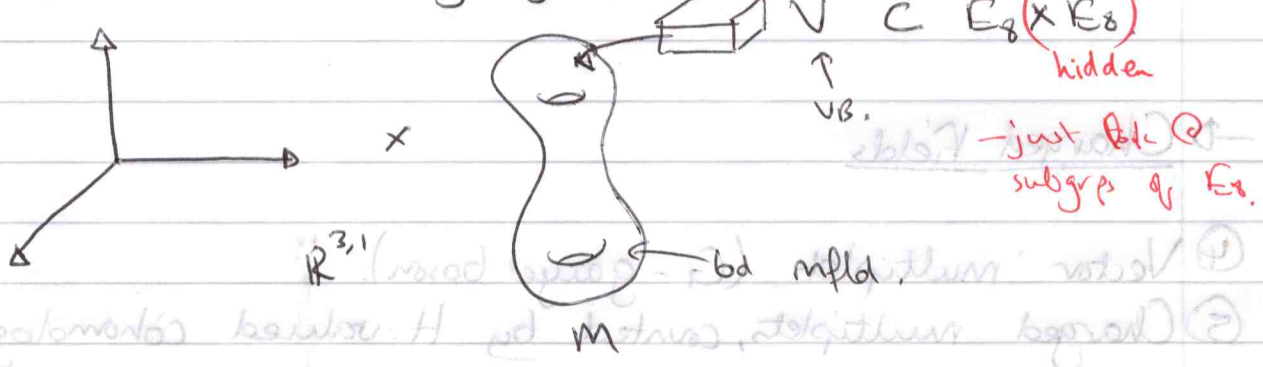
Heterotic vacua important.
→ Phenomenology (easy realise gauge thys GUT SU(5))
→ Mathematics (type II → mirror symmetry about CY_3 &
new facts about CY_3 & vector bundles).

SUGRA : $\frac{R}{l_s} \to \infty$

→ well understood.

String thy → little known.

AIM : Understand ~~abou~~ string thy of heterotic vacua.



– just fix ⊆ subgps of E_8.

(N=1 SUSY).

EOMs → ① $R_{IJ} = 0 \longrightarrow M = CY_3$
② $F_{(0,2)} = F_{(2,0)} = 0$. (V is holomorphic).
③ $g^{IJ} F_{IJ} = 0$ HYM $\overset{DUY}{\longleftrightarrow}$ V "stable".
hermitian Yang Mills

Vacuum is anomaly free for $ch_2(M) = ch_2(V)$. $\left(\Leftrightarrow dH_3 = \mathrm{tr}\, R \wedge R - \mathrm{tr}\, F \wedge F\right)$

What is low energy theory? $N=1$ chiral gauge thy.

If H is the structure group of V then the gauge group

$G = [H, E_8]$

eg $H = SU(3)$, $G = E_6$.

$H = SU(4)$, $G = SO(10)$

$H = SU(5)$, $G = SU(5)$.

FIELD CONTENT

→ Neutral fields

① Gravity multiplet
② $h^{1,1} + h^{2,1}$ neutral chiral multiplets. (Kahler + complex st.)
③ $h^{bun} = \dim H^1(M, \mathrm{End}\, V)$.

→ Charged fields

④ Vector multiplet (G - gauge boson).
⑤ Charged multiplets, counted by H-valued cohomology groups.

~~H = SU(3)~~

Eg $H = SU(3)$, $G = E_6$:

$h^{1,1} = \dim H^1(M, V^*)$
multiplets in $\overline{27}$ of E_6.

$h^{2,1} = \dim H^1(M, V)$ in $\overline{\overline{27}}$ of E_6.

$\mathcal{L} = \mathcal{L}_{KE} + \mathcal{L}_{Yuk} + \cdots$

$\mathcal{L}_{Yuk} = (\text{topological invariants})$

$(\overline{27})^3 = \int_M J \wedge J \wedge J + \cdots$

↑ quantum corrected.
How to compute this?

Examples & Expectations

→ $g_s \to 0$, α' dominates

→ "Standard Embedding"

Choose $V = TM$ (TM ↑ tangent bundle.) $\quad [A = \omega]$.

- well understood.