New superconformal models in six dimensions

Workshop on Fields and Strings
Theory-Cosmology-Phenomenology Corfu
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[HS, E Sezgin, R Wimmer, arXiv:1108.4060]
[B de Wit, H Nicolai, HS, arXiv:0801.1294]

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motivation: superconformal models in six dimensions

actions for the dynamics of multiple M5 branes

- single brane: (2,0) chiral tensor multiplet: $\left\{B_{\mu\nu}, \chi^i, \phi^{ij}\right\}$ $(dB)^- = 0$
- multiple branes: non-abelian deformation
- no-go theorems

lessons from M2 branes

[Bagger, Lambert, Gustavsson '07]
[Aharony, Bergman, Jafferis, Maldacena, '08]

- non-dynamical fields may be crucial (BLG)
- full supersymmetry may not be manifest (ABJM)

$\longrightarrow$ **study (1,0) non-abelian superconformal models in six dimensions**

plan

- **nonabelian tensor fields in six dimensions**
  - non-abelian tensor hierarchy
  - parameters and constraints
- **superconformal field equations**
  - (1,0) supersymmetry
  - action (?)
- **examples**
  - gauge groups
  - vacua and spectra
- **conclusions / outlook**

nonabelian tensor fields in six dimensions

nonabelian tensor fields in six dimensions

- **field content** $\{A^r_\mu,\, B^I_{\mu\nu},\, C_{\mu\nu\rho\, r}\}$

- **covariant field strengths (Yang-Mills)**

$$\mathcal{F}^r_{\mu\nu} \;\equiv\; 2\partial_{[\mu}A^r_{\nu]} - f_{st}{}^r A^s_\mu A^t_\nu$$

- **non-abelian gauge transformations**

$$\delta A^r_\mu \;=\; D_\mu \Lambda^r$$

with structure constants $f_{rs}{}^t$ and gauge generators X_r

nonabelian tensor fields in six dimensions

[B de Wit, HS, '05]
[B de Wit, H Nicolai, HS, '08]
[J. Hartong, T. Ortin, '09]

- **field content** $\{A^r_\mu,\, B^I_{\mu\nu},\, C_{\mu\nu\rho\, r}\}$

- **covariant field strengths**

$$\mathcal{F}^r_{\mu\nu} \;\equiv\; 2\partial_{[\mu}A^r_{\nu]} - f_{st}{}^r A^s_\mu A^t_\nu + h^r_I\, B^I_{\mu\nu}$$

$$\mathcal{H}^I_{\mu\nu\rho} \;\equiv\; 3D_{[\mu}B^I_{\nu\rho]} + 6\, d^I_{rs} A^r_{[\mu}\partial_\nu A^s_{\rho]} - 2 f_{pq}{}^s d^I_{rs} A^r_{[\mu}A^p_\nu A^q_{\rho]} + g^{Ir} C_{\mu\nu\rho\, r}$$

- **non-abelian gauge transformations**

$$\delta A^r_\mu \;=\; D_\mu \Lambda^r - h^r_I \Lambda^I_\mu$$

$$\Delta B^I_{\mu\nu} \;=\; 2D_{[\mu}\Lambda^I_{\nu]} - 2\, d^I_{rs}\Lambda^r \mathcal{F}^s_{\mu\nu} - g^{Ir}\Lambda_{\mu\nu\, r}$$

$$\Delta C_{\mu\nu\rho\, r} \;=\; 3D_{[\mu}\Lambda_{\nu\rho]\, r} + 3\, b_{Irs}\, \mathcal{F}^s_{[\mu\nu}\,\Lambda^I_{\rho]} + b_{Irs}\, \mathcal{H}^I_{\mu\nu\rho}\,\Lambda^s + \ldots$$

$$\Delta B^I_{\mu\nu} \;\equiv\; \delta B^I_{\mu\nu} - 2 d^I_{rs}\, A^r_{[\mu}\,\delta A^s_{\nu]}$$

$$\Delta C_{\mu\nu\rho\, r} \;\equiv\; \delta C_{\mu\nu\rho\, r} - 3\, b_{Irs}\, B^I_{[\mu\nu}\,\delta A^s_{\rho]} - 2\, b_{Irs}\, d^I_{pq}\, A^s_{[\mu}\, A^p_\nu\, \delta A^q_{\rho]}$$

in terms of constant tensors $d^I_{rs},\, b_{Irs},\, f_{rs}{}^t,\, g^{Ir},\, h^r_I$ and gauge generators X_r

nonabelian tensor fields in six dimensions

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- **field content** $\{A^r_\mu,\, B^I_{\mu\nu},\, C_{\mu\nu\rho\, r}\}$

- **covariant field strengths**

$$\begin{aligned}
\mathcal{F}^r_{\mu\nu} &\equiv 2\partial_{[\mu}A^r_{\nu]} - f_{st}{}^r A^s_\mu A^t_\nu + h^r_I\, B^I_{\mu\nu} \\
\mathcal{H}^I_{\mu\nu\rho} &\equiv 3D_{[\mu}B^I_{\nu\rho]} + 6\, d^I_{rs} A^r_{[\mu}\partial_\nu A^s_{\rho]} - 2 f_{pq}{}^s d^I_{rs} A^r_{[\mu}A^p_\nu A^q_{\rho]} + g^{Ir} C_{\mu\nu\rho\, r}
\end{aligned}$$

- **non-abelian gauge transformations**

$$\begin{aligned}
\delta A^r_\mu &= D_\mu \Lambda^r - h^r_I \Lambda^I_\mu \\
\Delta B^I_{\mu\nu} &= 2D_{[\mu}\Lambda^I_{\nu]} - 2\, d^I_{rs}\Lambda^r \mathcal{F}^s_{\mu\nu} - g^{Ir}\Lambda_{\mu\nu\, r} \\
\Delta C_{\mu\nu\rho\, r} &= 3D_{[\mu}\Lambda_{\nu\rho]\, r} + 3\, b_{Irs}\, \mathcal{F}^s_{[\mu\nu}\, \Lambda^I_{\rho]} + b_{Irs}\, \mathcal{H}^I_{\mu\nu\rho}\, \Lambda^s + \ldots
\end{aligned}$$

$$\begin{aligned}
\Delta B^I_{\mu\nu} &\equiv \delta B^I_{\mu\nu} - 2d^I_{rs}\, A^r_{[\mu}\, \delta A^s_{\nu]} \\
\Delta C_{\mu\nu\rho\, r} &\equiv \delta C_{\mu\nu\rho\, r} - 3\, b_{Irs}\, B^I_{[\mu\nu}\, \delta A^s_{\rho]} - 2\, b_{Irs}\, d^I_{pq}\, A^s_{[\mu}\, A^p_\nu\, \delta A^q_{\rho]}
\end{aligned}$$

in terms of constant tensors $d^I_{rs}, b_{Irs}, f_{rs}{}^t, g^{Ir}, h^r_I$ and gauge generators X_r

nonabelian tensor fields in six dimensions

covariant field strengths

$$\mathcal{F}^r_{\mu\nu} \equiv 2\partial_{[\mu}A^r_{\nu]} - f_{st}{}^r A^s_\mu A^t_\nu + h^r_I\, B^I_{\mu\nu}$$

$$\mathcal{H}^I_{\mu\nu\rho} \equiv 3D_{[\mu}B^I_{\nu\rho]} + 6\, d^I_{rs} A^r_{[\mu}\partial_\nu A^s_{\rho]} - 2 f_{pq}{}^s d^I_{rs} A^r_{[\mu}A^p_\nu A^q_{\rho]} + g^{Ir} C_{\mu\nu\rho\, r}$$

consistency requires a number of constraints on the parameters :

gauge group generators

$$(X_r)_s{}^t = -f_{rs}{}^t + d^I_{rs}\, h^t_I$$

$$D_\mu = \partial_\mu - A^r_\mu X_r$$

$$(X_r)_I{}^J = 2\, h^s_I d^J_{rs} - g^{Js} b_{Isr}$$

close into the algebra $[X_r, X_s] = (X_r)_s{}^t X_t$

- charged tensor fields require Stückelberg-type coupling
- generalized Bianchi identities $D\mathcal{F}^r = h^r_I \mathcal{H}^I$, etc.
- continues to 4-forms, 5-forms, ...

nonabelian tensor fields in six dimensions

- **covariant field strengths**

$$\mathcal{F}^r_{\mu\nu} \;\equiv\; 2\partial_{[\mu}A^r_{\nu]} - f_{st}{}^r A^s_\mu A^t_\nu + h^r_I\, B^I_{\mu\nu}$$

$$\mathcal{H}^I_{\mu\nu\rho} \;\equiv\; 3D_{[\mu}B^I_{\nu\rho]} + 6\, d^I_{rs} A^r_{[\mu}\partial_\nu A^s_{\rho]} - 2 f_{pq}{}^s d^I_{rs} A^r_{[\mu}A^p_\nu A^q_{\rho]} + g^{Ir} C_{\mu\nu\rho\, r}$$

consistency requires a number of constraints on the parameters :

$$\begin{aligned}
2\left(d^J_{r(u}d^I_{v)s} - d^I_{rs}d^J_{uv}\right) h^s_J &= 2f_{r(u}{}^s d^I_{v)s} - b_{Jsr}d^J_{uv}\, g^{Is}\,, \\
\left(d^J_{rs}\, b_{Iut} + d^J_{rt}\, b_{Isu} + 2\, d^K_{ru}b_{Kst}\delta^J_I\right) h^u_J &= f_{rs}{}^u b_{Iut} + f_{rt}{}^u b_{Isu} + g^{Ju} b_{Iur} b_{Jst} \\
f_{[pq}{}^u f_{r]u}{}^s - \tfrac{1}{3} h^s_I\, d^I_{u[p} f_{qr]}{}^u &= 0 \\
h^r_I g^{Is} &= 0 \\
f_{rs}{}^t h^r_I - d^J_{rs}\, h^t_J h^r_I &= 0 \\
g^{Js} h^r_K b_{Isr} - 2 h^s_I h^r_K\, d^J_{rs} &= 0 \\
-\, f_{rt}{}^s g^{It} + d^J_{rt} h^s_J g^{It} - g^{It} g^{Js} b_{Jtr} &= 0
\end{aligned}$$

for the constant tensors $d^I_{rs}, b_{Irs}, f_{rs}{}^t, g^{Ir}, h^r_I$

nonabelian tensor fields in six dimensions

covariant field strengths

$$
\begin{aligned}
\mathcal{F}^r_{\mu\nu} &\equiv 2\partial_{[\mu}A^r_{\nu]} - f_{st}{}^r A^s_\mu A^t_\nu + h^r_I\, B^I_{\mu\nu} \\
\mathcal{H}^I_{\mu\nu\rho} &\equiv 3D_{[\mu}B^I_{\nu\rho]} + 6\, d^I_{rs} A^r_{[\mu}\partial_\nu A^s_{\rho]} - 2 f_{pq}{}^s d^I_{rs} A^r_{[\mu}A^p_\nu A^q_{\rho]} + g^{Ir} C_{\mu\nu\rho\, r}
\end{aligned}
$$

consistency requires a number of constraints on the parameters :

$$
\begin{aligned}
2\left(d^J_{r(u}d^I_{v)s} - d^I_{rs}d^J_{uv}\right) h^s_J &= 2 f_{r(u}{}^s d^I_{v)s} - b_{Jsr} d^J_{uv}\, g^{Is}\;, \\
\left(d^J_{rs}\, b_{Iut} + d^J_{rt}\, b_{Isu} + 2\, d^K_{ru} b_{Kst}\delta^J_I\right) h^u_J &= f_{rs}{}^u b_{Iut} + f_{rt}{}^u b_{Isu} + g^{Ju} b_{Iur} b_{Jst} \\
f_{[pq}{}^u f_{r]u}{}^s - \tfrac{1}{3} h^s_I\, d^I_{u[p} f_{qr]}{}^u &= 0 \\
h^r_I g^{Is} &= 0 \\
f_{rs}{}^t h^r_I - d^J_{rs}\, h^t_J h^r_I &= 0 \\
g^{Js} h^r_K b_{Isr} - 2 h^s_I h^r_K\, d^J_{rs} &= 0 \\
- f_{rt}{}^s g^{It} + d^J_{rt} h^s_J g^{It} - g^{It} g^{Js} b_{Jtr} &= 0
\end{aligned}
$$

violation of Jacobi identities

orthogonality

too many constraints ? are there solutions ?

nonabelian tensor fields in six dimensions

covariant field strengths

$$\mathcal{F}^r_{\mu\nu} \equiv 2\partial_{[\mu}A^r_{\nu]} - f_{st}{}^r A^s_\mu A^t_\nu + h^r_I\, B^I_{\mu\nu}$$

$$\mathcal{H}^I_{\mu\nu\rho} \equiv 3D_{[\mu}B^I_{\nu\rho]} + 6\, d^I_{rs} A^r_{[\mu}\partial_\nu A^s_{\rho]} - 2 f_{pq}{}^s d^I_{rs} A^r_{[\mu}A^p_\nu A^q_{\rho]} + g^{Ir} C_{\mu\nu\rho\, r}$$

some examples (which satisfy all constraints)

- **abelian limit**

  $f_{rs}{}^t = 0,\ g^{Ir} = 0,\ h^r_I = 0$ free theory with nontrivial Chern-Simons term

- **Yang-Mills with neutral tensor fields**

  $g^{Ir} = 0,\ h^r_I = 0,\ d^I_{rs} = d^I \eta_{rs}$ no Stückelberg-type couplings

  [E. Bergshoeff, E. Sezgin, E. Sokatchev, '96]

- **Yang-Mills with adjoint tensor fields**

  $h^r_s = 0,\ g^{rs} = \eta^{rs},\ b_{t\,rs} = f_{rst}$ coupling of three-forms, charged tensors

superconformal symmetry

superconformal field equations

(1,0) supermultiplets

vector $\{A^r_\mu,\, \lambda^r_i,\, Y^r_{ij}\}$ tensor $\{B^I_{\mu\nu}, \chi^I_i, \phi^I\}$ three-form $\{C_{\mu\nu\rho\, r}\}$

off-shell on-shell ??

superconformal field equations

- **(1,0) supermultiplets**

vector $\{A^r_\mu, \lambda^r_i, Y^r_{ij}\}$ tensor $\{B^I_{\mu\nu}, \chi^I_i, \phi^I\}$ three-form $\{C_{\mu\nu\rho\, r}\}$

- **closure of the supersymmetry algebra on the tensor multiplet implies**

$$\begin{aligned}
\mathcal{H}^{I\,-}_{\mu\nu\rho} &= -d^I_{rs}\bar{\lambda}^r\gamma_{\mu\nu\rho}\lambda^s \\
\gamma^\sigma D_\sigma \chi^{iI} &= \tfrac{1}{2}d^I_{rs}\mathcal{F}^r_{\sigma\tau}\,\gamma^{\sigma\tau}\lambda^{is} + 2d^I_{rs}Y^{ij\,r}\,\lambda^s_j + \left(d^I_{rs}h^s_J - 2b_{Jsr}g^{Is}\right)\phi^J\lambda^{ir} \\
D^\mu D_\mu\,\phi^I &= -\tfrac{1}{2}d^I_{rs}\left(\mathcal{F}^r_{\mu\nu}\mathcal{F}^{\mu\nu\,s} - 4\,Y^r_{ij}Y^{ij\,s} + 8\bar{\lambda}^r\gamma^\mu D_\mu\lambda^s\right) \\
&\quad - 2\left(b_{Jsr}g^{Is} - 8d^I_{rs}h^s_J\right)\bar{\lambda}^r\chi^J - 3\,d^I_{rs}h^r_J h^s_K\,\phi^J\phi^K
\end{aligned}$$

tensor multiplet is onshell: Yukawa couplings, (cubic) scalar potential

superconformal field equations

(1,0) supermultiplets

vector $\{A^r_\mu,\, \lambda^r_i,\, Y^r_{ij}\}$ tensor $\{B^I_{\mu\nu}, \chi^I_i, \phi^I\}$ three-form $\{C_{\mu\nu\rho\, r}\}$

- **closure of the supersymmetry algebra on the tensor multiplet implies**

$$
\begin{aligned}
\mathcal{H}^{I\,-}_{\mu\nu\rho} &= -d^I_{rs}\bar{\lambda}^r\gamma_{\mu\nu\rho}\lambda^s \\
\gamma^\sigma D_\sigma \chi^{iI} &= \tfrac{1}{2}d^I_{rs}\mathcal{F}^r_{\sigma\tau}\,\gamma^{\sigma\tau}\lambda^{is} + 2d^I_{rs}Y^{ij\,r}\,\lambda^s_j + \left(d^I_{rs}h^s_J - 2b_{Jsr}g^{Is}\right)\phi^J\lambda^{ir} \\
D^\mu D_\mu\,\phi^I &= -\tfrac{1}{2}d^I_{rs}\left(\mathcal{F}^r_{\mu\nu}\mathcal{F}^{\mu\nu\,s} - 4\,Y^r_{ij}Y^{ij\,s} + 8\bar{\lambda}^r\gamma^\mu D_\mu\lambda^s\right) \\
&\quad - 2\left(b_{Jsr}g^{Is} - 8d^I_{rs}h^s_J\right)\bar{\lambda}^r\chi^J - 3\,d^I_{rs}h^r_J h^s_K\,\phi^J\phi^K
\end{aligned}
$$

tensor multiplet is onshell: Yukawa couplings, (cubic) scalar potential

- **supersymmetry of these equations implies**

$$
\begin{aligned}
b_{Irs}\left(Y^s_{ij}\,\phi^I - 2\bar{\lambda}^s_{(i}\chi^I_{j)}\right) &= 0 \\
b_{Irs}\left(\mathcal{F}^s_{\mu\nu}\phi^I - 2\,\bar{\lambda}^s\gamma_{\mu\nu}\chi^I\right) &= \tfrac{1}{4!}\,\varepsilon_{\mu\nu\lambda\rho\sigma\tau}\,\mathcal{H}^{(4)\,\lambda\rho\sigma\tau}_r
\end{aligned}
$$

vector multiplet also onshell: three-forms are dual to vectors

superconformal field equations

- **can these equations be lifted to an action ?**

yes! provided that there is a constant metric η_{IJ}

and the parameters are related as $h_I^r = \eta_{IJ} g^{Jr}$, $2\, d_{rs}^I = \eta^{IJ} b_{Jrs}$

$$\begin{aligned}
\mathcal{L} \;=\; & -\tfrac{1}{8} D^\mu \phi_I\, D_\mu \phi^I - \tfrac{1}{2} \bar{\chi}_I\, \gamma^\mu D_\mu \chi^I + \tfrac{1}{16} b_{Irs} \phi^I \left(\mathcal{F}_{\mu\nu}^r \mathcal{F}^{\mu\nu\, s} - 4 Y_{ij}^r Y^{ij\, s} + 8 \bar{\lambda}^r \gamma^\mu D_\mu \lambda^s \right) \\
& - \tfrac{1}{96} \mathcal{H}_{\mu\nu\rho}^I\, \mathcal{H}_I^{\mu\nu\rho} - \tfrac{1}{48} b_{Irs} \mathcal{H}_{\mu\nu\rho}^I\, \bar{\lambda}^r \gamma^{\mu\nu\rho} \lambda^s - \tfrac{1}{4} b_{Irs} \mathcal{F}_{\mu\nu}^r\, \bar{\lambda}^s \gamma^{\mu\nu} \chi^I + b_{Irs} Y_{ij}^r\, \bar{\lambda}^{i\, s} \chi^{j\, I} \\
& + \tfrac{1}{2} \left(b_{Jsr} g_I^s - 4 b_{Isr} g_J^s \right) \phi^I \bar{\lambda}^r \chi^J + \tfrac{1}{8} b_{Irs} g_J^r g_K^s\, \phi^I \phi^J \phi^K - \tfrac{1}{48} \mathcal{L}_{\rm top} \\
& - \tfrac{1}{24} b_{Irs} b_{uv}^I\, \bar{\lambda}^r \gamma^\mu \lambda^u \bar{\lambda}^s \gamma_\mu \lambda^v \,,
\end{aligned}$$

Yukawa couplings, cubic scalar potential, topological term

$$\int_{\partial M_7} \mathcal{L}_{\rm top} \;\propto\; \int_{M_7} \left(b_{Irs}\, \mathcal{F}^r \wedge \mathcal{F}^s \wedge \mathcal{H}^I - \mathcal{H}^I \wedge D\mathcal{H}_I \right)$$

duality has to be imposed by hand (“democratic”) – or HT/PST style

no dimensionfull constants, classically superconformal

indefinite metrics (ghosts) : $g^{Ir} \eta_{IJ}\, g^{Js} \;\equiv\; 0 \qquad K_{rs} \;\equiv\; b_{I\,rs}\, \phi^I$

examples

- **models with G adjoint tensor multiplets** $\{B^r_{\mu\nu}\}$

  - **vectors in G** $\{A^r_\mu\}$

    $$h^r_s = 0,\ g^{rs} = \eta^{rs},\ b_{t\,rs} = f_{rst}$$

    YM field strength, Stückelberg-type coupling of tensors to three-forms, potential vanishes, no action

  - **vectors in G x G** $\left\{A^r_\mu, A^{r'}_\mu\right\}$ [Chu, arXiv:1108.5131]

    $$f_{rs}{}^t = \mathsf{f}_{rs}{}^t\,, \quad f_{rs'}{}^{t'} = -f_{s'r}{}^{t'} = \frac{1}{2}\mathsf{f}_{rs'}{}^{t'}$$

    $$d^t_{rs'} = d^t_{s'r} = -\frac{1}{2}\mathsf{f}_{rs'}{}^t\,, \quad h^{r'}_s = \delta^{r'}_s$$

    $$g^{rs} = 0 = g^{rs'}$$

    no three-forms, Stückelberg-type coupling of vectors to tensors, potential vanishes, no action

examples

models with an action

16 vectors, 10 self-dual tensors, based on magic gamma identities of SO(10)

- **SO(5) gauge group** $SO(5) \;\subset\; GL(5) \;\subset\; SO(5,5)$

$$b^I_{rs} \;\equiv\; \gamma^I_{rs}\,, \qquad f_{rs}{}^t \;\equiv\; -4\,\gamma^{IJK}_{rs}\gamma_{IJ\,p}{}^t\,g^p_K \qquad\qquad g^p_K \;\propto\; \mathbf{1}$$

tensors: two copies of fundamental representation

indefinite metric, potential vanishes

- **T_8 gauge group** $T_8 \;\subset\; (SO(8)\times SO(1,1))\ltimes T_8 \;\subset\; SO(9,1)$

$$g^{Ir} \;\equiv\; \zeta^r\zeta^s\zeta^t\gamma^I_{st}$$

nilpotent gauge group

indefinite metric, cubic potential $\mathcal{L} \;=\; -\tfrac{1}{8}D^\mu\phi^i\,D_\mu\phi^i - \tfrac{1}{8}\partial^\mu\phi^+D_\mu\phi^- + g^3(\phi^+)^3$

vacua and spectra

maximally supersymmetric vacuum

$$0 \overset{!}{\equiv} \delta\lambda^{i\,r} = \tfrac{1}{8}\gamma^{\mu\nu}\mathcal{F}^{r}_{\mu\nu}\epsilon^{i} - \tfrac{1}{2}Y^{ij\,r}\epsilon_{j} + \tfrac{1}{4}h^{r}_{I}\phi^{I}\epsilon^{i}$$

constant scalar fields with $\phi^{I}_{0}\, h^{r}_{I} \equiv 0$

fluctuations around the vacuum

fall into multiplets

$$(\mathrm{V}) \;:\; \Box A_\mu = 0\,, \quad \partial\!\!\!/\lambda = 0\,,$$

$$(\mathrm{T}) \;:\; \Box\varphi = 0\,, \quad \partial\!\!\!/\chi = 0\,, \quad (dB)^{-} = 0\,,$$

free vector / tensor multiplets

$$(\mathrm{TV}) \;:\; \Box\varphi = 0\,, \quad \kappa\, dA = {}^{*}dC\,, \quad (dB)^{-} = -gC^{-}\,, \quad \partial\!\!\!/\lambda = 0\,, \quad \partial\!\!\!/\chi = -2g\kappa\lambda\,,$$

$$(\mathrm{VT}) \;:\; \Box\varphi = 0\,, \quad \Box A_\mu = 0\,, \quad (dB)^{-} = 0\,, \quad \partial\!\!\!/\chi = 0\,, \quad \partial\!\!\!/\lambda = 2g\,\chi\,.$$

non-decomposable vector-tensor multiplets

indefinite metric, higher-derivative theory?

conclusions / outlook

- **non-abelian (1,0) superconformal models in six dimensions**
  - coupling to three-form gauge potentials
  - equations of motion $\longrightarrow$ action
- **consistency constraints and solutions**
  - models with G adjoint tensor fields (no action)
  - compact gauge group SO(5) with action (distinguished?)
- **vacua and spectra**
- **understand their structure / quantization**
  - ghosts: gauge fixing, imposing further constraints ...
  - cubic potential
- **classification: solutions to the consistency constraints**
  - Jacobi identities, fundamental identities, ...
- **extension to (2,0) theories, relation to D=5 SYM**
  - include hypermultiplets, non-propagating vector multiplets