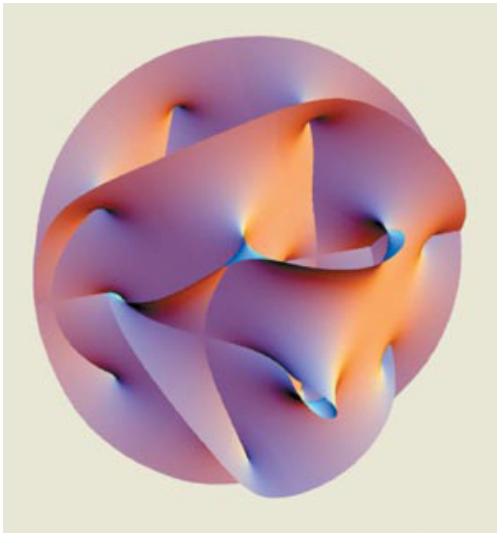

Chalmers theory

Niclas Wyllard

Partikeldagarna 2008

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Organisation

Elementary particle theory	Mathematical physics
Lars Brink (professor)	Bengt Nilsson (professor)
Måns Henningson (professor)	Martin Cederwall (professor)
Robert Marnelius (professor)	Gabriele Ferretti (professor)
Per Salomonson (docent)	Ulf Gran (foass)
Niclas Wyllard (foass)	Ling Bao (student)
Fredrik Ohlsson (student)	Christoffer Petersson (student)

Sung-Soo Kim (EU postdoc, Sep 2008-Jan 2009)

Dario Francia (EU postdoc, Aug 2006-Aug 2008)

Mirela Bābālîc (EU PhD student, Aug 2007-Aug 2008)

Main area of research: "string theory"

(supersymmetric gauge theories, supergravity, branes, ...)

We like to study $\mathcal{N}$-extended supersymmetric gauge theories.

$$\mathcal{N} = \frac{\text{Number of gluinos}}{\text{Number of gluons}} \quad \text{(roughly)}$$

$\mathcal{N}$ is bounded above. In $3+1$ spacetime dimensions:
$\mathcal{N} \leq 4$ (Yang-Mills gauge theories), $\mathcal{N} \leq 8$ (supergravity).

The theories with maximal supersymmetry are especially interesting.

Why study such theories?

They are not realistic as theories of nature...

but they are very likely the simplest quantum gauge field theories.

This is contrary to naive expectations since adding extra gluinos appears to add complexity.

Starting from simplest models can hopefully lead to insights into more complicated models. The models are also interesting in their own right.

Such theories have many interesting symmetries. (Simple theories always have large symmetries).

Examples include: S-duality, Superconformal symmetry, ...

Selected research activities

- Progress towards the classification of all supersymmetric solutions to $\mathcal{N} = 1$, $D = 4$ supergravity $\rightarrow$ important for phenomenology.
  (Ulf Gran)

- Studies of the structure of vacuum states in maximally supersymetric Yang-Mills theories in four- and five-dimensional spacetimes with periodic boundary conditions in the spatial directions. The results confirm that such theories can have their origin in a more abstract quantum theory in a six-dimensional spacetime.
  (Måns Henningson, Niclas Wyllard)

- Stringy instantons: Extended objects present in string theory that can induce non-perturbative effects on gauge theories. These include ordinary gauge instanton effects but also new "stringy" contributions. The new terms are of potential interest for SUSY breaking, moduli stabilisation etc...
  (Gabriele Ferretti, Christoffer Petersson)

- Coupling of BLG to $N = 8$ superconformal CS gravitation $\rightarrow$ generalisation to non-flat backgrounds and also reminiscent of the Polyakov formulation of the string.
  (Bengt Nilsson, Ulf Gran)

- An attempt to better understand UV divergence structure of $\mathcal{N} = 8$ Supergravity, using on-shell light-cone formulation to build counter terms for pure gravity and $\mathcal{N} = 8$ Supergravity in four dimensions. Currently working on three-point counter terms in this direction.
  (Lars Brink, Sung-Soo Kim)

- Studies of the theory on multiple M2-branes.
  (Martin Cederwall, Bengt Nilsson, Ulf Gran, Christoffer Petersson)

- A study of the relation between the pure spinor and κ-symmetric formulations for the M2-brane (Mirela Bābālîc, Niclas Wyllard)