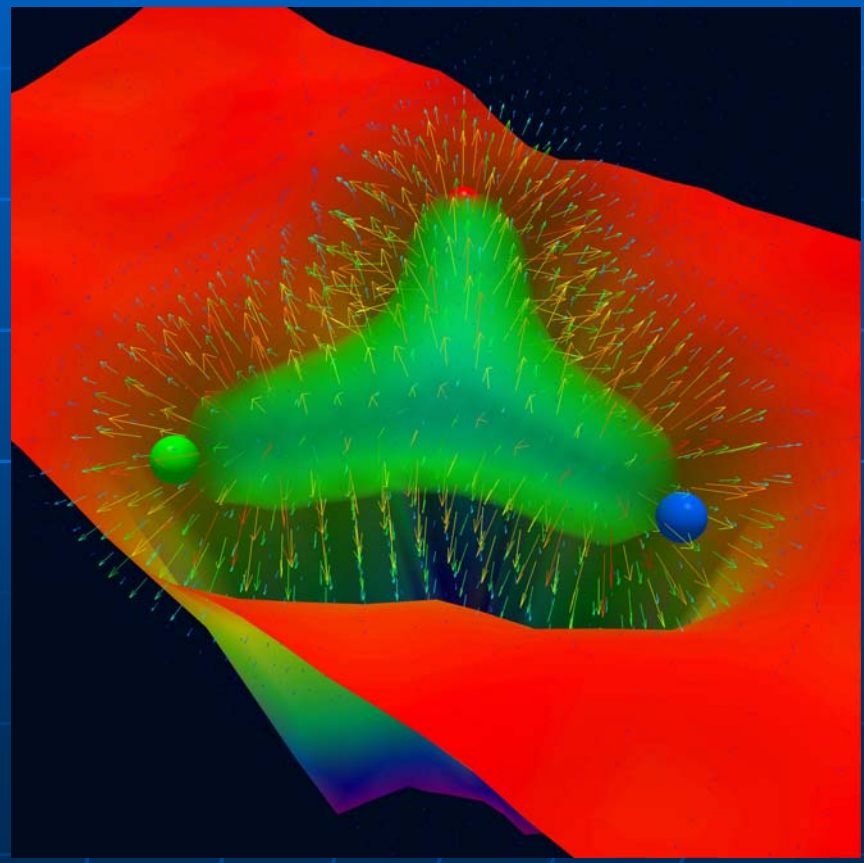
The DESY String Theory Group

J. Teschner

Two big questions I

- How do quarks and gluons behave at strong coupling?

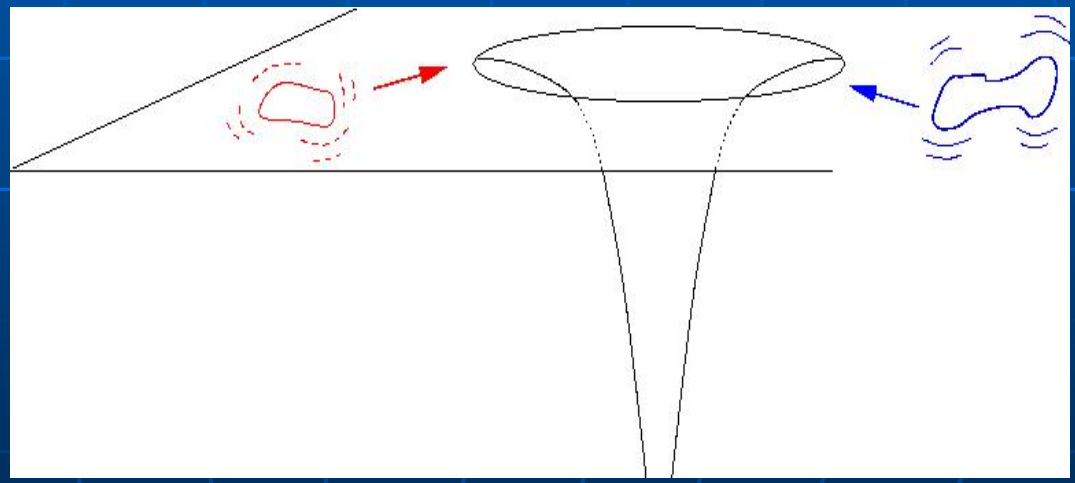


Two big questions - II

- How behave strings on curved space-times?

-Black holes ?

-Cosmology ?

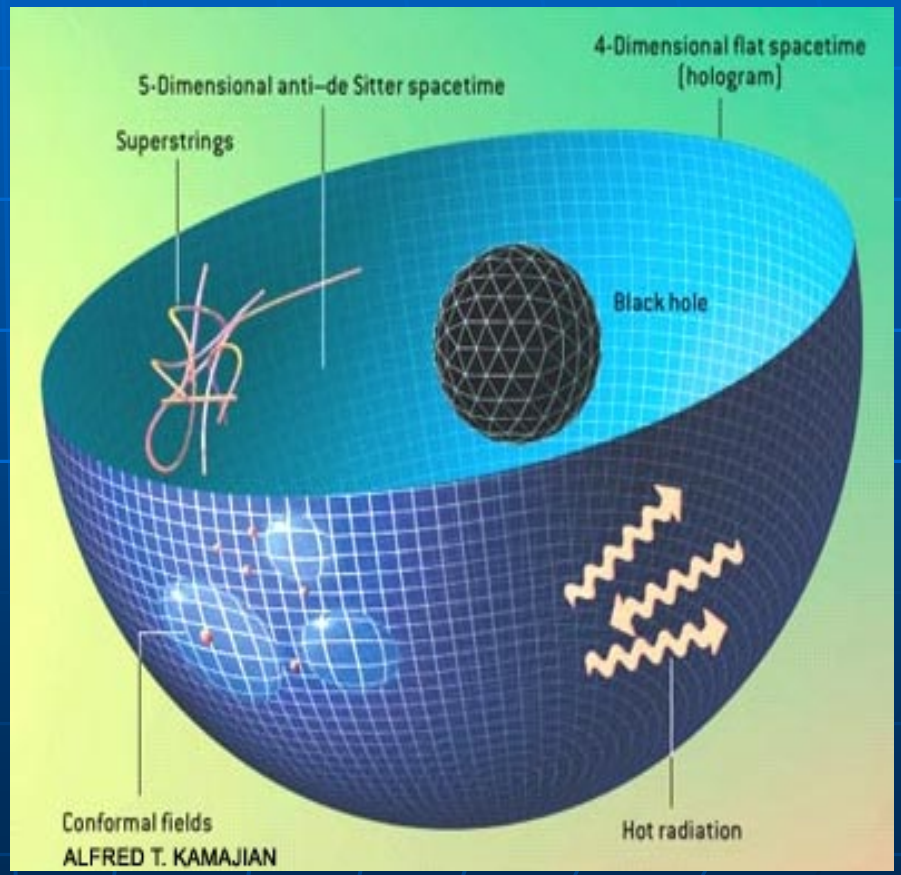


These two questions are related:

- Gauge theory in four dimensions

=

- Hologram of string theory in five dimensions



Research Program – main goals

A) Spectrum of string theory in AdS
=> Anomalous dimensions in N=4 SYM

- Calculation by means of nonlinear integral equations

B) Covariant quantization of strings in curved spaces

- esp. SUSY-sigma models
- First-principle (constructive!) approach to integrability
- These sigma models are also relevant for condensed matter theory !

C) Integrability in high-energy QCD (BFKL)

- relation with integrability in N=4 SYM ?
- with HH university QCD group

Research program - methods

A) Spectrum of string theory on AdS

- light-cone quantization
- techniques from integrable models: functional relations
- Nonlinear integral equations

B) Cov. quant. of strings on curved spaces

- Integrable lattice discretizations, T/Q-operators
- Nonrational conformal field theory

C) Integrability in high-energy QCD

- Baxter equations

Our group …

- Principal investigators:
  V. Schomerus, J. Teschner
- 1 Junior Staff, 3+3 Postdocs, 4 PhD Students
- Hosts J.T.'s Marie Curie Excellence Team
- Unique expertise on non-perturbative methods for string theory on curved spaces, conformal field theory, integrable models

.. shapes the scientific landscape ..

- Organization of conferences and workshops
- Intensive visitor program – Long- and short-term
- Teaching – Hamburg University, summer schools, “String Steilkurs”
- Networking – SFB 676, Northern German string theory, Strings and Integrability
- Driving role in the Center of Mathematical Physics (ZMP) – joint venture with HH university mathematics

Research program - results

1) Nonperturbative dualities in sigma-models

- WZNW-Liouville duality (J.T.)
- 2d black hole – Sine Liouville duality (V. Schomerus ...)

2) Spectra of SUSY-sigma models

- PSU(1,1|2), Superspheres (V. Schomerus et. al.)

3) Integrable Structure of CFT

- Separation into left- and right movers (J.T.)

4) Spectra of integrable sigma models

- Description by means of NLIE, functional equations for the Principal Chiral model (Gromov (DESY), Kazakov , Viera)
- Sinh-Gordon model: Complete description of spectrum (J.T.)

Supplement I
Conferences and workshops

- Workshop on Applied 2d Sigma models (2008)
- Theory workshop: “String Theory Meets Collider Physics” (2007)
- Workshop on the geometric Langlands program (2007)
- String-Steilkurs, Part II (2007)
- Workshop Strings and high energy QCD (2006)
- 2 Northern German String theory meetings
- ZMP opening colloqium (2005)
- ...

Supplement II
The Center for Mathematical Physics

Joint venture of

- University of Hamburg Mathematics

  (V. Cortes, B. Richter, B. Siebert, C. Schweigert u.a.)
- University of Hamburg Theoretical Physics

  (K. Fredenhagen, J. Louis u.a.)
- DESY Theory

  (V. Schomerus, J. Teschner u.a.)

Activities:

- Organization of Conferences and workshops
- Kaehler Fellowships
- Series of colloqia