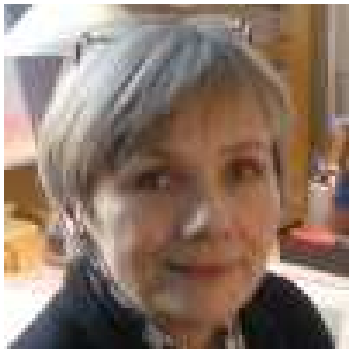
Two-minute meeting 2011

Scientific Group Activities

- Seminars (Organizers: Emil Bjerrum-Bohr, Donovan Young)
- Journal club (Organizer: Ricardo Monteiro)
- PhD meetings (Organizers: Agnese Bissi, Jakob Gath)

Group secretary:

- Anna Maria Rey (Tue-Wed-Thu) in FB8A.



(F-building is the building of the canteen, B first floor, C second floor)

Utility items

- “Lounge” FB6 for discussions, journal club, other social activities, coffee
- Two group bikes (Pick up the key and note your name on the sheet in the kitchen of the FC floor).
- Group homepage, face-book page, mailing lists ($\longrightarrow$ Costas Zoubos)

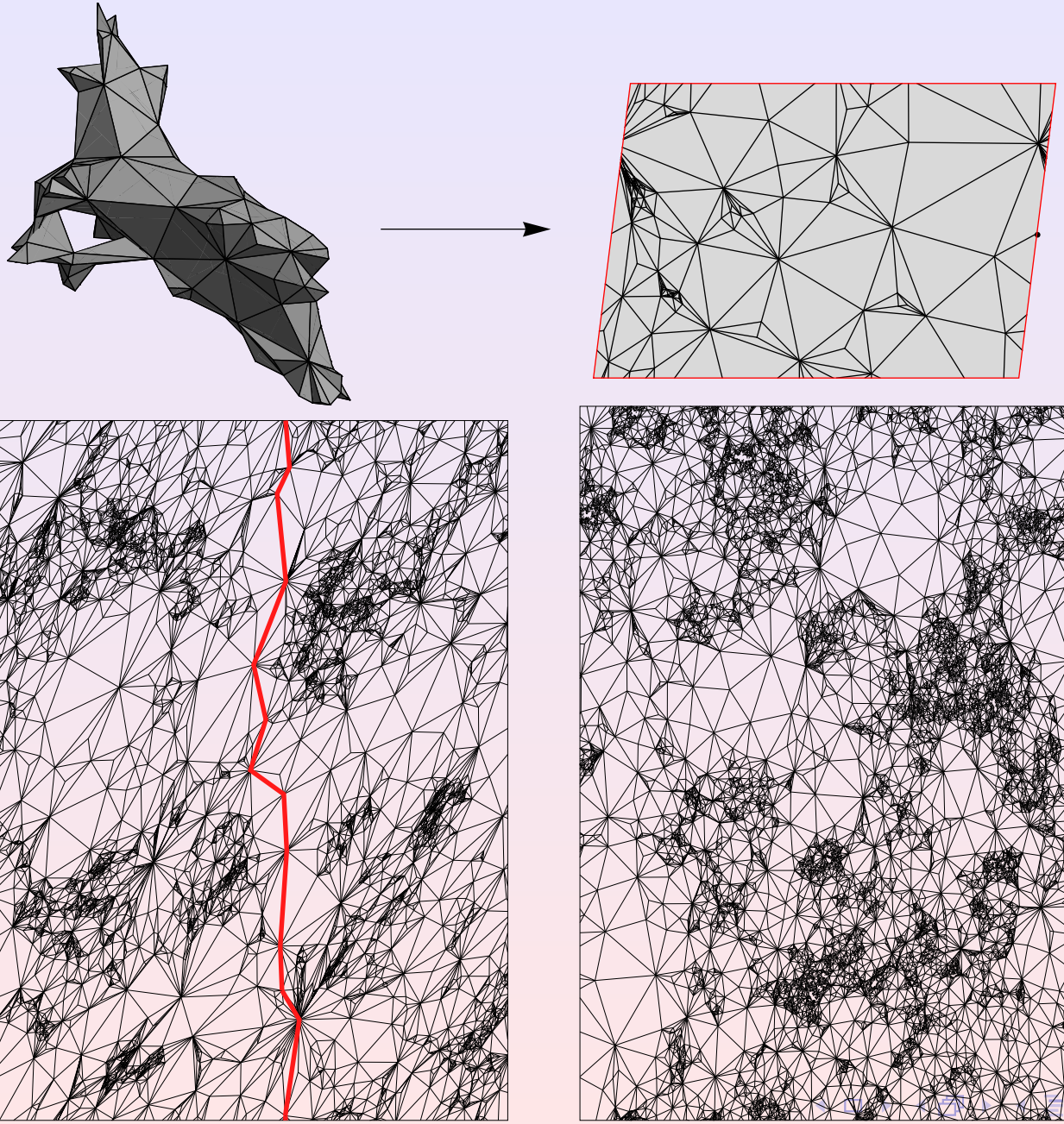
Two-minute meeting 2011

New group members since last meeting

- Postdocs: Andrzej Görlich, Jelle Hartong, Florian Löbbert, Guido Macorini, Valery Yundin, Yang Zhang
- PhD students: Hjalte Frellesvig (NBI), Lisa Glaser (Aachen/Imperial), Ara Martyrosian (Yerevan), Yuki Sato (visiting from Nagoya University)
- Master students: 15 in total

Upcoming events

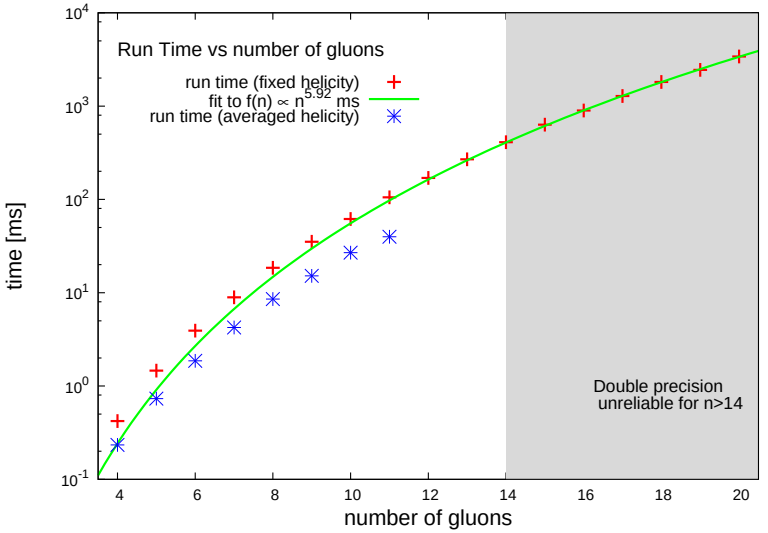
- The 28th Nordic Network Meeting on “Strings, Fields and Branes” at NORDITA, Stockholm Dec 1–3. (Registration deadline: Nov. 15)
- Northern String Theory Meeting, Feb. 20-21 at NBI (To be announced)



Simon Badger

- NBIA & Discovery Center
- Precision predictions for SM backgrounds at the LHC
- Multi-leg amplitudes at Next-to-Leading Order
  - Analytic computations for massive amplitudes
  - Numerical codes for multi-parton amplitude in QCD : `NGluon`

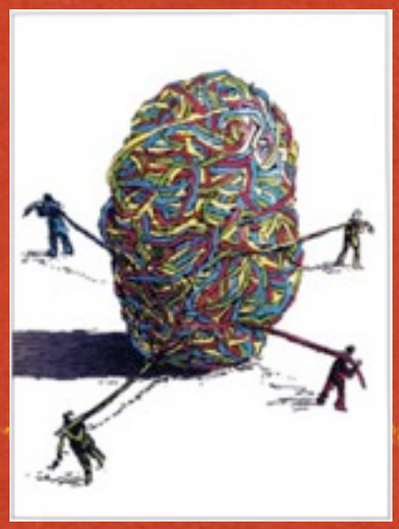
- Generalised Unitarity approach
- Recursions relations for tree-level ingredients
- Polynomial growth with external legs
- Applications to multi-jet rates at the LHC



Holger Bech Nielsen:

- (New) String Field Theory Second quantizing strings in a way letting right and left movers on the string be described as seperate (existing) entities. With M. Ninomiya.
- What is so Special about the Standard Model Group? We seek to invent a game in which the Standard Model Gauge Group would get the highest score. With D. Bennett.
- How can Space time be Flat? Need for spontaneous breaking at sub-Planckian distances of translation invariance("Guendelmann variables"). H. Kleinerts chrystal with defects gravity model. With D. Bennett.
- Plebanski-Kleinert The Kleinert chrystal of foregoing project is connected to Plebanski's gravity formulation. With L. Laperashvili...
- Tunguska, Dark Matter The Tunguska event hundred years ago were a ball of dark matter shut deep into the earth; hot earth material were ejected through a "Kimberlite".With C. D. Froggatt

Agnese Bissi



- I am PhD student, under the supervision of Charlotte.
- I am interested in integrability in gauge and string theory.
- I am coorganizing (with Jakob) PhD meetings. If anyone wishes to give an elementary talk...is very welcome!

Two-minute presentation.

High-Energy and Cosmology Group

Name: Emil Bjerrum-Bohr, NBIA/HET

Research Interests:

Analytic properties of amplitudes in field theories

Relevant for understanding the physics and phenomenology in and beyond the Standard model.

New breakthroughs in understanding

Computations of amplitudes

- Yang-Mills / QCD
- Gravity
- string theory
- twistor / helicity methods
- new symmetries

Quantum gravity / gravity as an effective field theory.

Poul Henrik Damgaard

Current research interests:

- QCD amplitude calculations
- QCD in a finite box in the chiral limit
- Fluctuations and statistics of multiplicity distributions in $p-p$ and heavy ion collisions

Interested in moving more towards:

- Astroparticle physics and cosmology
- Particle physics phenomenology (data!)

High energy scattering of a closed string on a stack of N Dp branes

Paolo Di Vecchia

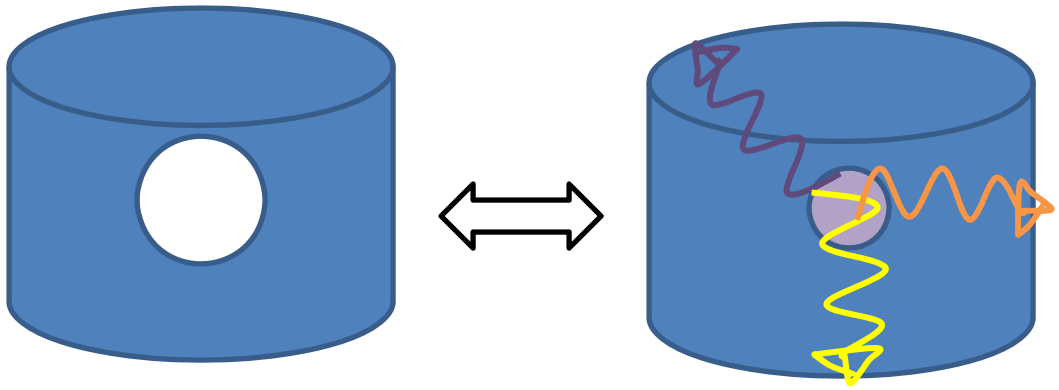
With G. D'Appollonio, R. Russo and G. Veneziano,
JHEP 1011 (2010) 100.

High energy scattering on a stack of N Dp branes

- Study the properties of a stack of N Dp branes from the scattering of a high energy massless particle as a function of the impact parameter b, the energy E , the string length $\sqrt{\alpha'}$ and the curvature of the background R_p.
- Curved space-time emerges from string amplitudes computed in flat Minkowski space-time.
- The scattering amplitudes diverge with the energy and unitarity is restored by a re-summation of loop diagrams.
- In this way one can construct eikonal operator.
- From it one gets the correct deflection angle of a massless particle moving in the background generated by the Dp branes plus string corrections (tidal excitations).
- These results are recovered by studying a classical string in the background generated by the Dp branes at large impact parameter.

Thomas Døssing – current research projects

Sonoluminescence:
(with Mogens Levinsen)



Investigate competing theories of the emission of light from the compressed heated gas in the collapsed bubble:
bremsstrahlung – bound-free molecular transitions – line broadening – black body radiation

Working on bremsstrahlung calculation with coherent multiscattering – promising first results. Next steps: multiscattering of electrons with realistic mixture of ions and atoms – evaluate mean free path of light in bubble

Vibrations of neutron rich nuclei
(with Christina Losa et. al)

Accomplished consistent description of vibrations for axially deformed nuclei,
Including all terms of the Skyrme interaction. Possible next steps: extend to nuclei in a netron gas in the crust of neutron stars.

Name:	Hjalte Frellesvig
Title:	PhD-student (start Jan. 2011)
Affiliation:	NBIA and Discovery Center
Advisors:	Poul Henrik Damgaard and Simon Badger
Research:	Field theory, Scattering amplitudes, Generalized unitarity.

2 min presentation
27 oct. 2011

Jakob Gath

PhD student, supervisor Niels Obers

Research interests:

Gravity; The phase structure and dynamics of higher dimensional black holes.

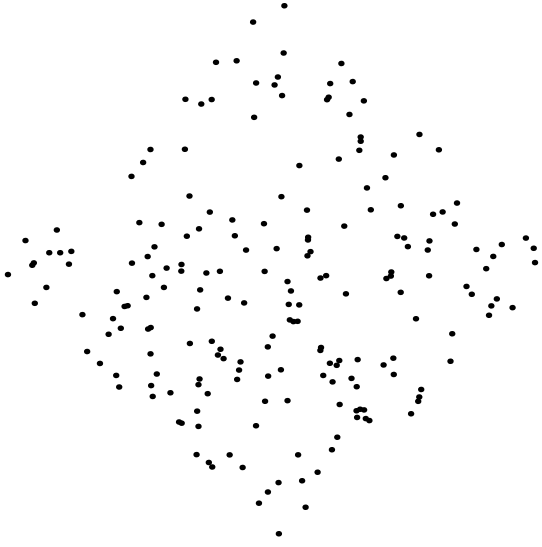
Current research:

- Generalizations of the blackfold method to adS.
- Constructions using matched asymptotic expansion.
- Blackfolds in non-trivial backgrounds.

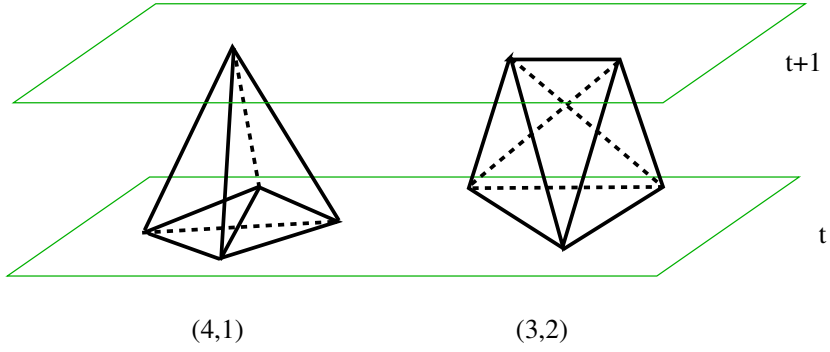
Lisa Glaser

PhD Student with Jan Ambjørn,

Causal Set



Causal Dynamical Triangulation



I like **discrete** Spacetime ...

Lisa Glaser

PhD Student with Jan Ambjørn,

I like discrete Spacetime and **smooth** whisky

Andrzej Görlich

Quantum gravity

C*ausal* **D***ynamical* **T***riangulations* in Four Dimensions:

- Emergent 4D background geometry
- Quantum fluctuations
- Numerical simulations - Monte Carlo method
- Matter fields

Random matrix theory

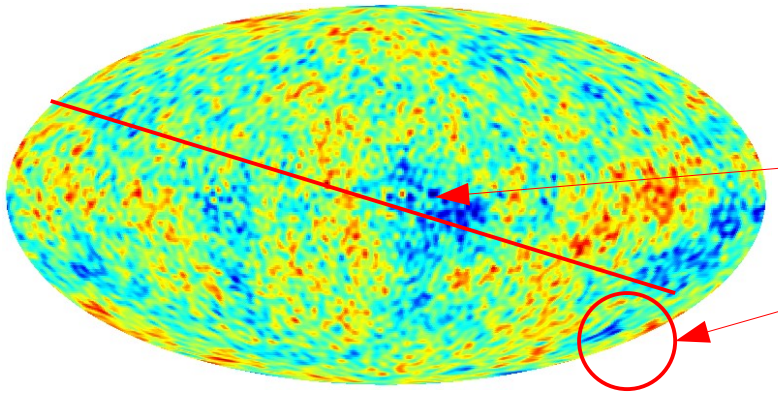
Relation between the eigenvalue spectrum of covariance matrix and its estimator for a class of non-Gaussian random matrices.

Quantum computing

Description of quantum gates (*NOT*, *CNOT*) based on *SQUID*s with emphasis on quantum decoherence.

Martin Hansen

Anomalies in the Cosmic Microwave Background



Examples of anomalies in the CMB:

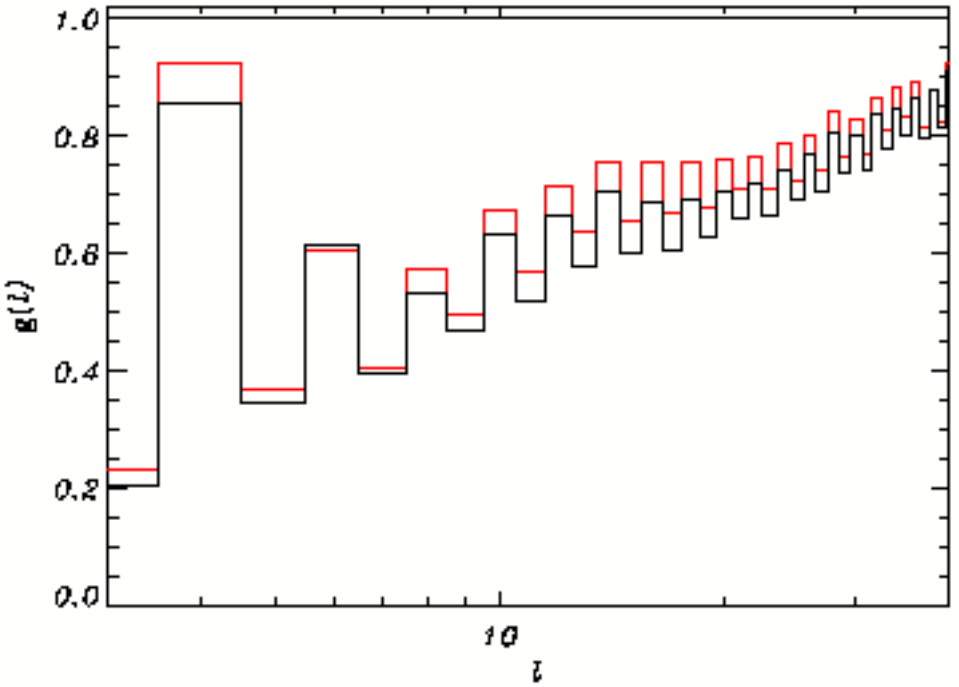
Alignment of quadru- octupole

The Cold Spot

Parity Asymmetry

$$\Delta T(\theta,\phi) = \sum_{l=0}^{\infty} \sum_{m=-l}^{l} a_{l,m} Y_{l,m}(\theta,\phi)$$

Even and odd ell does not carry same amount of power.
Figure on the right is the ratio between the power in even and odd multipoles.
Odd multipole preference for low multipoles.
Red = ILC map, Black = cut sky



Current research activities:

- Fefferman–Graham expansions for Schrödinger space-times in collaboration with Matthias Blau and Blaise Rollier.
- Constructing analytic Lifshitz black hole solutions in $\mathcal{N} = 2$, $D = 4$ supergravity in collaboration with Wissam Chemissany and Bert Vercnocke.
- Deriving the NSVZ beta function from anomaly matching in $\mathcal{N} = 1$ SYM in collaboration with Nicola Ambrosetti, Daniel Arnold and Jean–Pierre Derendinger.

Other research interests:

- holographic renormalization for non-relativistic holography
- blackfolds
- attractor mechanism

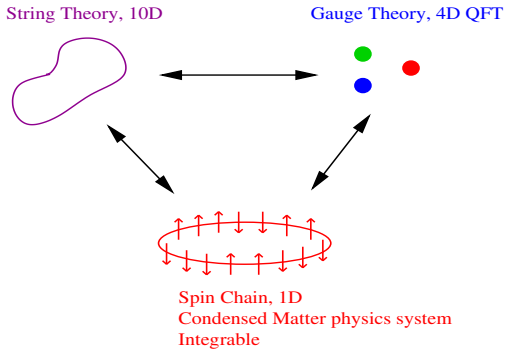
Research Interest

- Current Interest :
  - Analysis of CMB data
  - Statical anisotropy of early Universe
  - Physics at very large scales
- Future Interest :
  - Local anomalies in CMB data (Topological defects)

Jaiseung Kim

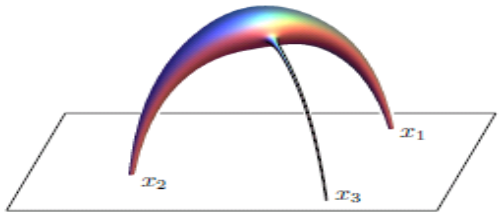
Charlotte Fløe Kristjansen

- Integrability in the AdS/CFT correspondence:



  The spectral problem of $\mathcal{N} = 4$ SYM, ABJM and ABJ theory, integrable spin chains and their Bethe equations, Wilson loops, giant gravitons, amplitudes

- Beyond integrability of the AdS/CFT correspondence: Nonplanar effects, three-point fucntions



- Discrete models of quantum gravity, matrix models, coloring and folding problems.

Phenomenology

- electroweak physics at LHC
- NLO e.w. corrections, "complementary" to NLO QCD
- background process, SM and search for NP
- Single top, MSSM Higgs + b jet, Top+H^+

Integrability in AdS-CFT

- TBA/Y-system to compute anomalous dimensions in $N = 4$ SYM
- weak coupling wrapping effects, $sl(2)$ sector and beyond
- strong coupling semiclassical string analysis, algebraic curve

ARA MARTIROSYAN

. I have done my Bachelor and Master at Yerevan State University (YSU) and wrote a master thesis under supervision of Ara Sedrakyan

. My master thesis was mostly about graphenes

. I have started my PhD recently under supervision of Charlotte Kristjansen

. My research interests include relations between gauge and string theories as well as integrabilty in them

Ricardo Monteiro - postdoc NBIA, 2010/13

Interests

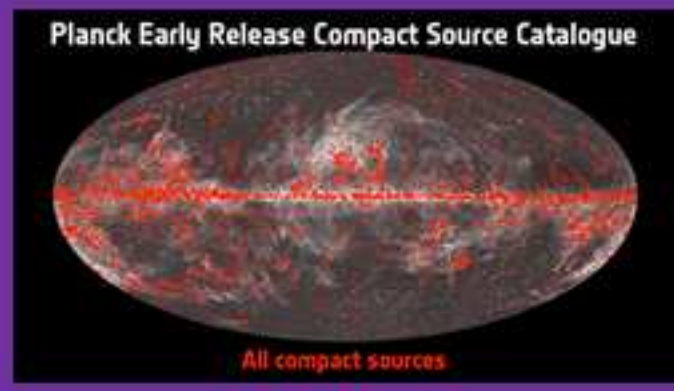
Black holes: phase diagrams (existence, stability) in higher dimensions / AdS, also fluid-gravity correspondence

Gauge-gravity correspondence (AdS/CFT): CFT correlation functions from string solutions in AdS, also “applications”

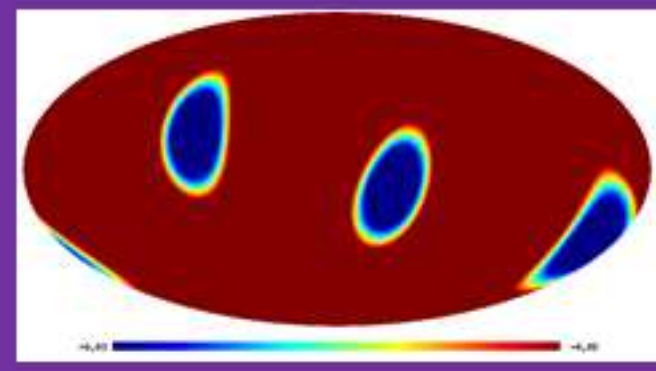
Scattering amplitudes: squaring relations between gravity and gauge theory amplitudes, hidden algebraic structures

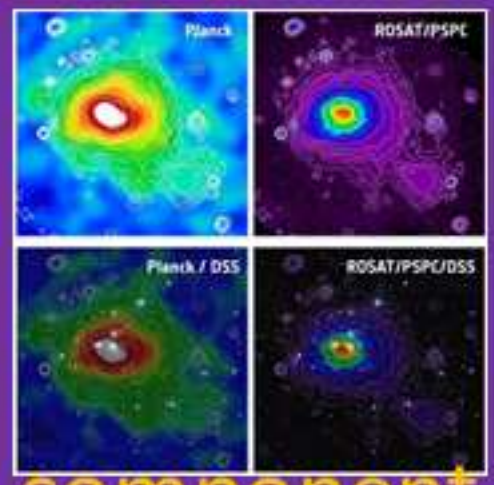
Activity and research

1. Cosmology and CMB. The PLANCK project.



2. The low multipole anomalies. Octupole.

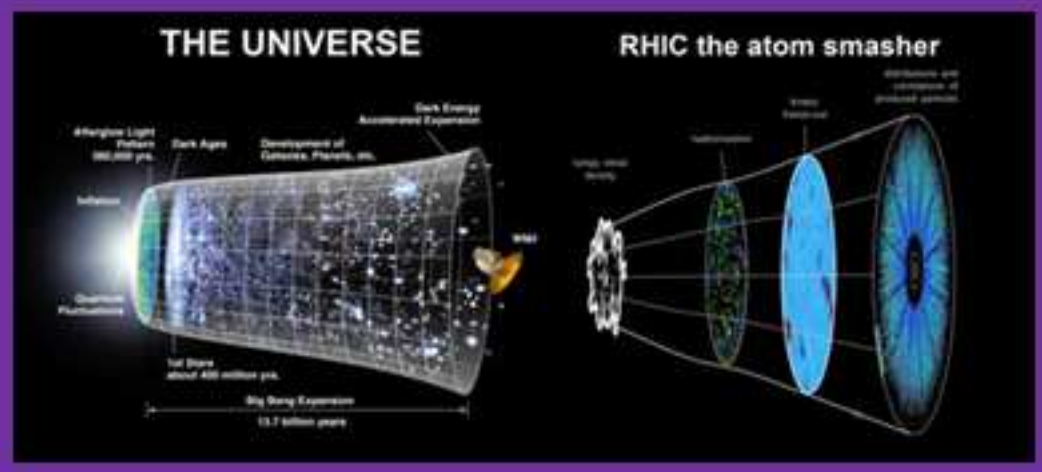




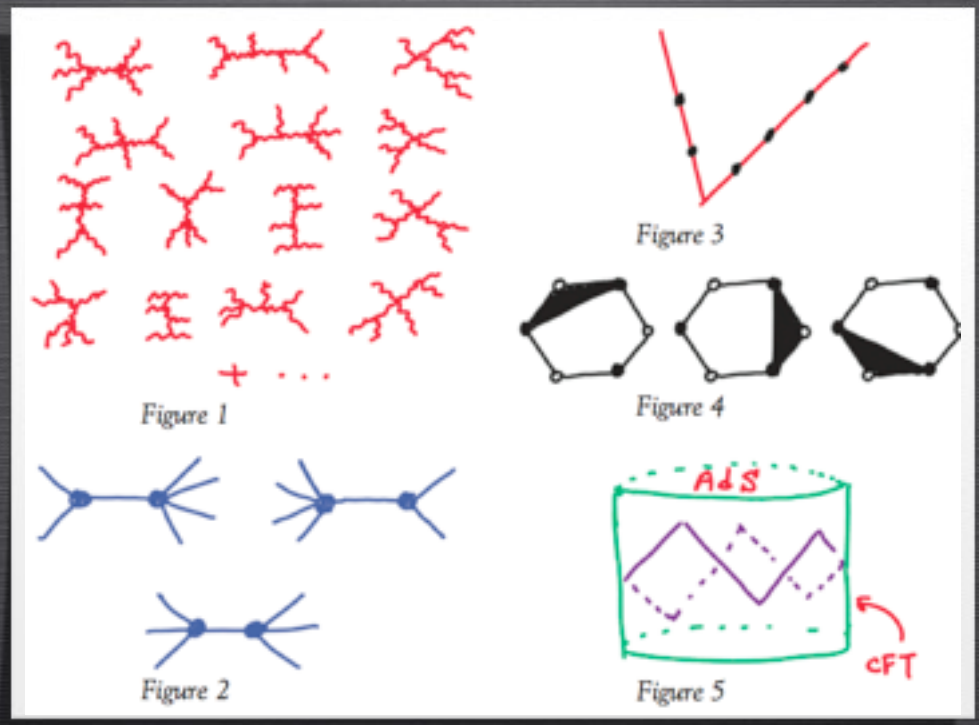
3.Discovery of new component of emissivity

4.Mapping ALICE experiment

27 papers



Donal O'Connell
NBIA Postdoc



Structure of Amplitudes in QFTs
LHC phenomenology

Research interests, Niels Obers (2 min. meeting 2011)

Blackfolds: black hole physics in higher-dimensional gravity and string theory

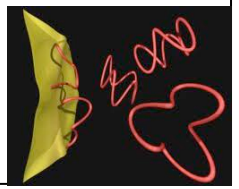
- black holes as “fluids” and “materials”
- (extremal) charged black holes in string theory/M-theory
- time-dependence + stability
- higher-order corrections

Aspects of the AdS/CFT correspondence

- thermal Wilson loops (thermal probes using BF)
- thermal Giant Gravitons
- fluid/gravity correspondence
- Lifshitz black holes and holography
- Nernst branes in gauged supergravity
- other holographies: Kerr/CFT, higher-spin…

Scattering amplitudes in gauge theory and ST

- amplitudes in curved backgrounds (pp-wave, CFTs, AdS ?)
- non-perturbative effects and U-duality



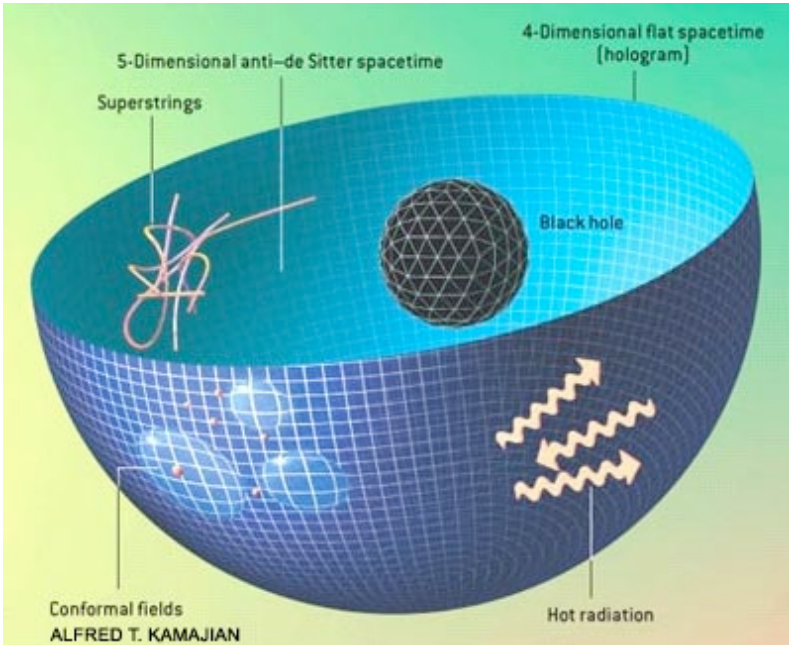
With:

Troels Harmark (Nordita), Jelle Hartong, Ricardo Monteiro, Marta Orselli, Costas Zoubos

Rutger Boels (DESY), Joan Camps (Durham), Vasilis Niarchos (Crete), Gianluca Grignani et al (Perugia), Gabriel Lopes Cardoso (Lisbon), Michael Haack et al (Munich)

Jay Armas, Jakob Gath Andreas, Vigand Pedersen (PhDs)

Gabriele Conti, Jakob Lorenzen, Heidar Moradi (MsC)



CHRIS PETHICK

27.10.2011

(NBIA + NORDITA)

NEUTRINO PROCESSES IN DENSE MATTER.

HOW DO SUPERNOVAE WORK?

NEED BETTER RATES

CHIRAL EFFECTIVE FIELD THEORY (CEFT)

BETTER MODELS OF NEUTRON STARS

USE CEFT FOR LOW DENSITIES
(LOTS OF OBSERVATIONS)

INTERACTION OF GRAVITATIONAL WAVES WITH MATTER

MATTER

GW

+ A. CETOLI arXiv: 1110.0408

MAKE GRAVITY LOOK LIKE ELECTROMAG.

BAND STRUCTURE OF NEUTRONS IN NEUTRON STAR CRUST

WHAT IS THE FERMI SURFACE LOOK LIKE WHEN THERE ARE UP TO 500 BANDS?

+ PHYSICS OF nEDM EXPERIMENT

Name: Yuki Sato (佐藤 勇貴)

sa to yu ki

Affiliation: PhD student @ Nagoya Univ.

Adviser (here): Prof. Jan Ambjørn

Interests: classical & quantum gravity, matrix models and string theory

Current works: "CDT w/ a matter,"
"n-DBI gravity,"
"Ads/CFT"

Thomas Søndergaard

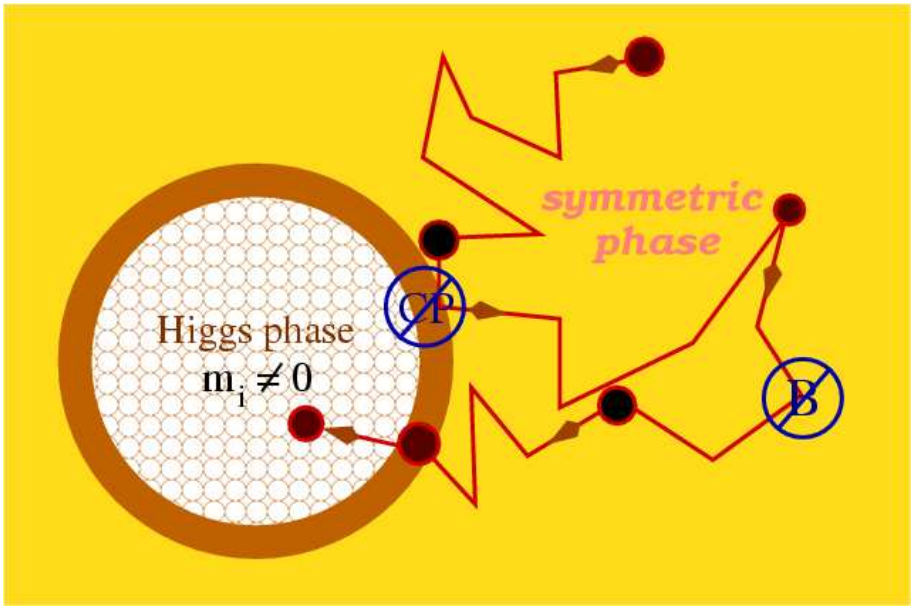
PhD Student at
Niels Bohr International Academy

Advisors:
Poul Henrik Damgaard
Emil Bjerrum-Bohr

Main research interest:
Structure and relations of scattering amplitudes in quantum field theory, quantum gravity and string theory.

Anders Tranberg,
NBI, NBIA, Discovery Center
anders.tranberg@nbi.dk

- Physics of the very early Universe ($> 100\,\mathrm{MeV}$).
- Particularly (Electroweak) Baryogenesis ...
- ...but also Inflation, (P)reheating, Topological defects, Q-balls.
- Numerical simulations of classical and quantum field theory, including...
- ... lattice field theory, 2PI/in-in/Keldysh-Schwinger/CTP...



Andreas Vigand Pedersen

PhD student – started last year
Academic advisor: Niels Obers

Background: Master from NBI

Interests:

- Physics
- Gravity theories
- Higher dimensional gravity
- The AdS/CFT correspondence and applied AdS/CFT

Currently investigating:

- Various aspects/generalizations of the blackfold approach
- Blackfold constructions in AdS/CFT
- Numerical approaches to blackfolds

Donovan Young

My general interest is AdS/CFT and gauge-gravity duality in general.

Wilson Loops

- in $d = 4$: $\mathcal{N} = 4$, $\mathcal{N} = 2$ SYM
- in $d = 3$: ABJM, SYM with 16 supercharges

Techniques include: matrix models (localization), straight-up perturbation theory, finding minimal surfaces and D-brane solutions, calculating correlation functions with local operators and other loops.

Gauge-Gravity in Three Dimensions (with Abhishek Agarwal)

- Theories with 16 supercharges: PWMM, SYM on $\mathbb{R} \times S^3$, SYM on $\mathbb{R} \times S^2$.
- Integrability
- Protected Wilson loops
- Scattering amplitudes

Valery Yundin

Rostov-on-Don
M.Sc.
→
DESY, Zeuthen
Ph.D.
→
since Oct 2011
NBIA/Discovery
Postdoc

Research interests

- Multi-leg NLO corrections to Standard Model
- Methods for evaluation of loop integrals
- Automation in particle physics research

Yang Zhang

Postdoc in NBIA & Discovery center

coming from Ithaca, NY...

Scattering amplitude: BCJ, KLT relations
String theory: heterotic string theory, throat geometry
Cosmology: quantum tunneling, cosmic string

Konstantinos (Costas) Zoubos

My Scientific Trajectory (so far):

- BSc '97 U. of Patras, MSc '98 Imperial College London
- PhD '04 Stony Brook, NY, USA
- Postdoc '05-'07 at Queen Mary, University of London
- At NBI since October 2007

My Research Interests:

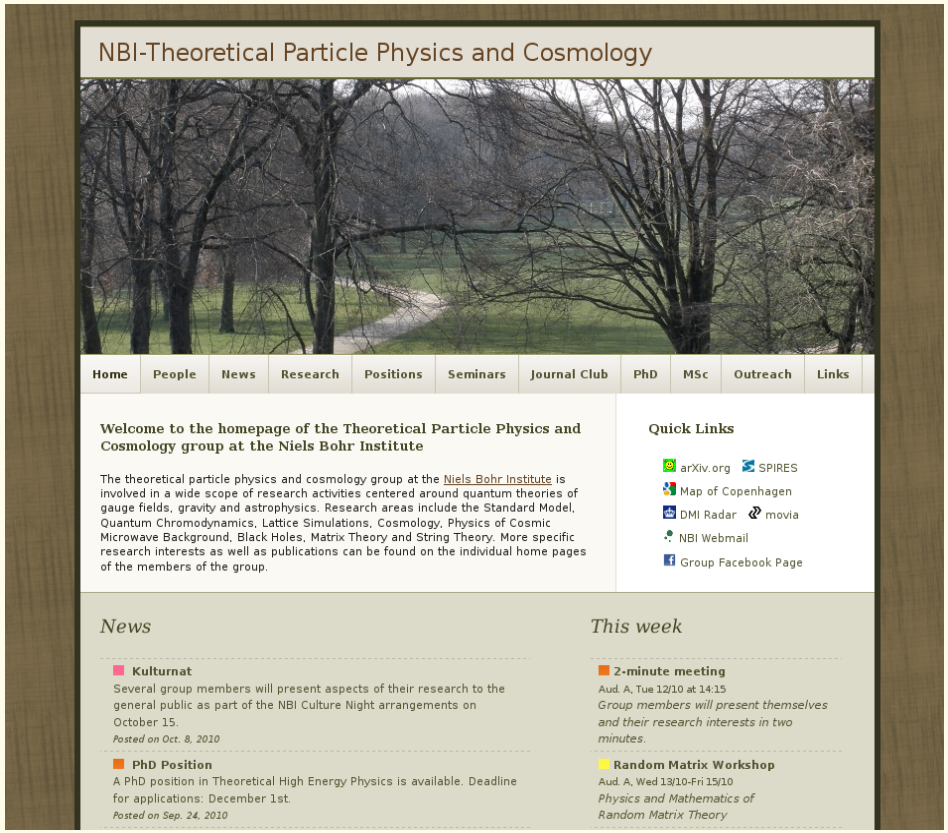
- Integrability (and its breaking) in Gauge and String Theory
- Finite Field Theories in $D > 2$ (Hidden symmetry?)
- Amplitudes in Gauge Theory (e.g. MHV lagrangian)
- Mathematical aspects of AdS/CFT (Conformal geometry)
- Wishlist: M-theory (e.g. fivebranes), AGT, RR backgrounds (pure spinors?), CFT, 3d gravity, Wall-crossing...

Other Roles in the Group:

- Involved in various workshops, teaching, outreach...
- Co-maintaining the Group website (mainly news and member pages)

The group website

http://hetcosmo.nbi.dk



- Please check your personal page and send me any corrections.
- Comments and suggestions are welcome!
- Whoever wants to get involved is even more welcome!!

The group facebook page

- Can be accessed without a facebook account
- Could be used for sharing interesting links (online talks, conferences, articles), pictures from group events etc.

The group mailing lists

- We have recently introduced several mailing lists for different subsets of the group members
  - `het-seminars@nbi.ku.dk` All group members, but also **non-members** who might be interested in the group's seminars, journal clubs, workshops etc. Widest possible list (contains `all.gen_teor@isis.ku.dk`)
  - `hetcosmo-all@nbi.ku.dk` All group members and long-term visitors (but not master's students!)
  - `hetcosmo-staff@nbi.ku.dk` Permanent group members
  - `hetcosmo-postdocs@nbi.ku.dk` Postdocs, long-term staff
  - `hetcosmo-phd@nbi.ku.dk` PhD students
  - `hetcosmo-msc@nbi.ku.dk` Master's students
  - `hetcosmo-guests@nbi.ku.dk` Current visitors and guests
  - `hetcosmo-alumni@nbi.ku.dk` Under construction
- Apart from `het-seminars`, any member of a list can post to that list.
- Suggestions for improvements are welcome!