



Particle, Strings and the Early Universe Collaborative Research Centre — SFB676

Gudrid Moortgat-Pick (Uni Hamburg/DESY)

homepage: <http://wwwiexp.desy.de/sfb676/>

Scientific Programme

- **Broad spectrum:**
 - A: String Theory / Mathematical Physics**
 - B: Particle Physics**
 - C: Cosmology / Astroparticle Physics**
- **Collaborative activity between University of Hamburg (UHH) and DESY scientists**
- **UHH: Institute for Experimental physics, 2. Institut of Theoretical Physics and Sternwarte (Harburg)**
- **Was very successive in the past and runs already in its 3rd phase, until 2018!**
 - **Chair: Jan Louis (up to 2016), Johannes Haller (now)**
- **In the following: short overview about the topics and contact persons**

String Theory and math. Physics

Goals: math. foundation of string physics, cosm.+PP connections

A1 — Particle Physics from String Compactifications (Particle Physics/String Theory)

Wilfried Buchmüller, Jan Louis

A3 — QCD and String Theory (Particle Physics/String Theory)

Sven-Olaf Moch, Volker Schomerus

A6 — Mathematical Aspects of String Compactifications (Mathematics/String Theory)

Jan Louis, Vicente Cortés

A9 — Loops and Legs (Mathematics/String Theory)

Bernd Kniehl, Rutger Boels

A10 — TQFT from and for 4d SUSY gauge theories (Mathematics/String Theory)

Christoph Schweigert, Jörg Teschner

A11 — Integrable Deformations of the AdS Superstring and their Dual Gauge Theories

(String Theory)

Gleb Arutyunov, Ingo Runkel, Jörg Teschner

Particle Physics (PP)

Goals: Window to BSM physics at LHC+e+e- LC, neutrino physics

B1 — Optimising the ILC setup: Physics Programme, running scenarios, design choices

Jenny List, Gudrid Moortgat-Pick

B2 — Boosted Topologies and Supersymmetry

Peter Schleper, Frank Tackmann

B4 — Unstable Quantum Fields and Higgs Vacuum

Bernd Kniehl

B8 — Global SM & BSM Fits Using Results from LHC and other Experiments

Johannes Haller, Georg Weiglein

B9 — Probing the Nature of Higgs Physics and Electroweak Symmetry Breaking with

Results from the LHC

Peter Schleper, Kerstin Tackmann, Georg Weiglein

B11 — Top-quark Physics at the LHC

Sven-Olaf Moch, Jürgen Reuter

Cosmology, Astroparticle Physics

Goals: Origin of dark matter, axions, leptogenesis, QFT@expan. Univ.

C1 — Axions and other very weakly interacting sub-eV particles (PP+Cosmology)

Dieter Horns, Andreas Ringwald

C2 — Dark Matter Searches (PP/Cosmology)

Marcus Brüggen, Dieter Horns

C3 — Leptogenesis and Dark Matter (PP/Cosmology)

Wilfried Buchmüller

C6 — Scalar Fields in Cosmology: Inflation, Dark Matter, Dark Energy (Cosmology/PP)

Jan Louis, Alexander Westphal

C9 — Cosmic Magnetic Fields and their role in High Energy Physics (Cosmology)

Robi Banerjee, Günter Sigl

C10 — Cosmological implications of first order phase transitions (Astroparticle Physics)

Thomas Konstandin, Günter Sigl

Events

- **Usually 2x y: SFB Colloquium**
 - whole afternoon, 2 invited speakers, related to diff. SFB topics
- **Usually 2x y@3 Fridays afternoons each: SFB Lectures**
 - focussing on new and specific topics
 - this year: grav. waves and early Universe, comp. Higgs models
- **Usually 1x y in spring: 2-days SFB meeting**
 - for SFB members only ! (so,.....try to become a member: email to me and to Wiebke Kircheisen if interested)
 - talks by SFB members
- **Different Conferences: see webpage**
- **Seminars,...many, but specifically:**
 - Workshop seminar: Particles, Strings and the early Universe

WORKSHOP SEMINAR

Particles, Strings, & the Early Universe

“Axions”

C. Grojean, T. Konstandin, A. Ringwald, G. Servant, A. Westphal

Timeline:

- 25.10 Strong CP problem, Θ dependence of QCD vacuum energy, neutron EDM
- 01.11 Axion solution and generic axion effective lagrangian, EDM with axion
- 08.11 Axion models and low energy couplings
- 15.11 High temperature potential
- 22.11 Astrophysical constraints
- 29.11 Axion cosmology: PQ breaking & inflation, isocurvature perturbations
- 06.12 Axion relic density, from misalignment mechanism and thermal axions
- 13.12 Axionic Strings and domain walls
- 19.12 Axion DM and large Scale Structures, Axion mini clusters
- 10.01 Axion-like fields as inflaton
- 17.01 Axions in String Theory
- 24.01 Detection techniques and Searches I
- 31.01 Detection techniques and Searches II
- 07.02 Relaxion

Date and Place:

Tue, 11 – 12:30
SR2, Building 2a at Bahrenfeld/DESY

Starting on:

25.10.2016

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- **Different Conferences:** see webpage
- **Seminars,...many, but specifically:**
 - Workshop seminar: Particles, Strings and the early Universe
- **Graduate School:** lecture courses during term times

IRTG — Graduate School

- Addressing often Master- and PhD Level, but not only !
- Also **Advanced Topics**
 - String and math. Physics
 - Particle Physics
 - Cosmology
 - Please ask me, if further details are needed
- Usually announced at the SFB homepage
 - <http://wwiexp.desy.de/sfb676/>
 - at the University server STine
 - at all the boards here on campus

E.g.



Lecture Course in the Integrated Research Training Group (IRTG)
of the SFB 676 "Particles, Strings and the Early Universe"

Winter Term 2016/2017

Phenomenology of Physics Beyond the Standard Model

C. Grojean and J. Reuter

Course Description:

The course will cover the following topics:

- Shortcomings of the Standard Model
- Constraining the deformations of the Standard Model: electroweak precision data, Higgs coupling measurements
- Supersymmetric Models: algebra, model building, susy breaking, collider signatures
- Grand unified models: SU(5), SO(10), proton decay
- Dark Matter: susy and non-susy models
- Models with extra dimensions: ADD, UED, Randall-Sundrum
- AdS/CFT for model building, holography
- Alternatives to an Elementary Higgs boson
- Composite Higgs models
- Effective field theories, naive dimensional analysis and power counting
- Cosmological relaxation of the weak scale
- BSM kinematics: resonances, cascades, spin correlations
- Multi-Boson physics: dibosons, tribosons, vector boson scattering

Prerequisites:

Basic knowledge in Quantum Field Theory or Advanced Particle Physics,
Physics of the Standard Model

Literature:

P. Ramond "Journeys beyond the Standard Model",
C. Csaki and P. Tanedo "Beyond the Standard Mode" arXiv:1602.04228

Date and Place: Mon 14:00-15:30, SR1, Geb. 1, Campus Bahrenfeld

Problem Classes: Thu 8:45-10:15, SR3, Geb. 1, Campus Bahrenfeld

Starting on: 17.10.2016

Please look at the boards!
You are welcome !

Students Council

- **Official representation of PhD students**
 - foster communication between IRTG students
 - contact point for students concerns
 - evaluate the IRTG activities
- **Currently:**
Markus Ebert, Bijan Chokufe, Anne Ernst, Christian Weiss
- **Specific SFB budget to organize:**
 - PhD days: 2-days meeting for PhDs
 - Set-up Colloquium on specific topics, e.g. next event in Feb17:
‘Physics and Philosophy’

Services@SFB676

So SFB does a lot scientifically, but what else?

- **offers/ed family and careers seminars**
- **offers a mentoring programme**
- **specific equal opportunity activities**
- **and lots more**

Facit: SFB676 is a great endeavour!

- **joined by University and DESY members**
- **comprehensive science programme at all levels**
- **You are welcome to join!**