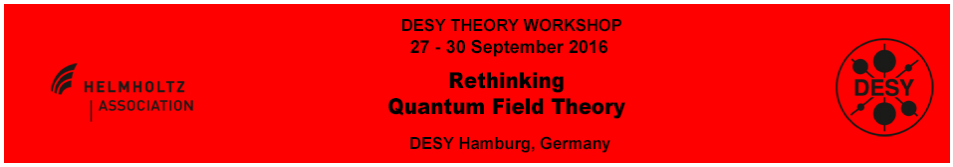
Rethinking Quantum Field Theory



Report of Contributions

https://indico.desy.de/e/14795

Contribution ID: **6** Type: **not specified**

Conformal symmetry breaking and evolution equations in Quantum Chromodynamics

Thursday, September 29, 2016 2:00 PM (20 minutes)

Quantum Chromodynamics (QCD) in non-integer d = 4 − 2e space-time dimensions possesses a nontrivial critical point where the theory enjoys exact scale and conformal invariance. As consequence there are three symmetry generators that commute with the renormalization group equation for composite operators.
The resulting constraints allow to reconstruct full evolution kernels in physical (integer) dimensions from their eigenvalues (anomalous dimensions) and the calculation of the conformal anomaly at one order less in a perturbative expansion.

We use this technique to derive three-loop, i.e. NNLO, evolution equations for flavor-nonsinglet quark-antiquark light-ray operators that encode the scale dependence of generalized hadron parton distributions and light-cone distribution amplitudes in the most compact form. In particular we calculate the two-loop correction to the generator of special conformal transformations at the critical
point in the modified theory that corresponds to the two-loop conformal anomaly in the physical theory. Using this result we fix the off-diagonal part of the evolution kernel at NNLO.

Primary author: Mr STROHMAIER, Matthias (University of Regensburg, Theoretical Particle Physics Department)

Presenter: Mr STROHMAIER, Matthias (University of Regensburg, Theoretical Particle Physics Department)

Session Classification: Parallel Session: Particle Phenomenology - QCD & BSM

Track Classification: Particle Phenomenology

Contribution ID: **10** Type: **not specified**

N=3 four dimensional field theories

Wednesday, September 28, 2016 4:55 PM (20 minutes)

I will describe a class of four dimensional field theories constructed by quotienting ordinary N=4 U(N) SYM by particular combinations of R-symmetry and SL(2,Z) automorphisms. These theories appear naturally on the worldvolume of D3 branes probing terminal singularities in F-theory, where they can be thought of as non-perturbative generalizations of the O3 plane. I will focus on cases preserving only 12 supercharges, where the quotient gives rise to theories with coupling fixed at a value of order one. These constructions possess an unconventional large N limit described by a non-trivial F-theory fibration with base AdS5×(S5/Zk). Upon reduction on a circle the N=3 theories flow to N=6 ABJM theories.

Primary authors: Dr REGALADO, Diego (MPP Munich); Dr GARCÍA-ETXEBARRIA, Iñaki (MPP Munich)

Presenter: Dr REGALADO, Diego (MPP Munich)

Session Classification: Parallel Session: Strings & Mathematical Physics

Track Classification: String & Mathematical Physics

Contribution ID: **12** Type: **not specified**

CHY in Collinear Limit

Thursday, September 29, 2016 2:15 PM (15 minutes)

We investigate the collinear behavior of tree level amplitudes in several theories using their CHY (Cachazo-He-Yuan) representation. We obtain the leading and subleading orders of the adjacent collinear limit and ask the question whether universality is present and how Einstein-Yang-Mills amplitudes emerge by checking specific identities due to Stieberger and Taylor.

Primary authors: Dr NANDAN, Dhritiman (Hu Berlin); Prof. PLEFKA, Jan (Hu Berlin); Mr WORMSBECHER, Wadim (Hu Berlin)

Presenter: Mr WORMSBECHER, Wadim (Hu Berlin)

Session Classification: Parallel Session: Strings & Mathematical Physics

Track Classification: String & Mathematical Physics

Contribution ID: **14** Type: **not specified**

Three-jet production in electron-positron annihilation with the ColorFulNNLO method

Wednesday, September 28, 2016 4:15 PM (20 minutes)

In my talk I introduce the ColorFulNNLO method to calculate NNLO QCD corrections to any IR-safe observable in the case of three-jet production in electron-positron annihilation. Provided the ColorFulNNLO method is general it was implemented in a computer code called MCCSM (Monte Carlo for the ColorFulNNLO Subtraction Method). The capabilities of the code are demonstrated by calculating standard event shape variables and comparing them to literature and providing, for the first time, NNLO QCD correction to energy-energy correlation, oblateness and jet cone energy fraction.

Primary author: Dr KARDOS, Adam (University of Debrecen)

Presenter: Dr KARDOS, Adam (University of Debrecen)

Session Classification: Parallel Session: Particle Phenomenology - QCD

Track Classification: Particle Phenomenology

Contribution ID: **15** Type: **not specified**

keV Sterile Neutrinos as Dark Matter

Wednesday, September 28, 2016 2:00 PM (15 minutes)

In the absence of a clear WIMP signal, we should think about alternative candidates for Dark Matter. A very well motivated example is a (up to now hypothetical) sterile neutrino with a mass of a few keV. In this talk, I will give an overview over the topic of keV sterile neutrino Dark Matter, with a particular focus on Dark Matter production in the early Universe and on phenomenological considerations. While WIMPs are not dead yet, they have to learn how to live in the neighbourhood of serious competitors.

Primary author: Dr MERLE, Alexander (Max-Planck-Institut für Physik)

Presenter: Dr MERLE, Alexander (Max-Planck-Institut für Physik)

Session Classification: Parallel Session: Cosmology & Astroparticle Physics

Track Classification: Cosmology & Astroparticle Physics

Contribution ID: **17** Type: **not specified**

Relic density at NLO: the IR finiteness

Wednesday, September 28, 2016 3:00 PM (15 minutes)

In recent years there has been an increasing interest in computations of the dark matter thermal relic density beyond the leading order in perturbation theory. In this talk we point out that the standard calculation, based on solving the Boltzmann equations, at NLO suffers from a temperature-dependent IR divergence. In an example model we show how both soft and collinear temperature-dependent divergences cancel when the collision term is instead computed in the thermal field theory formalism. We also discuss the remaining finite temperature-dependent correction and its interpretation within the EFT framework.

Primary author: Dr HRYCZUK, Andrzej (University of Oslo)

Presenter: Dr HRYCZUK, Andrzej (University of Oslo)

Session Classification: Parallel Session: Cosmology & Astroparticle Physics

Track Classification: Cosmology & Astroparticle Physics

Contribution ID: **18** Type: **not specified**

Scale-invariant models of inflation: a geometrical interpretation

Thursday, September 29, 2016 4:05 PM (15 minutes)

I will describe how the geometrical properties of the target manifold affect the inflationary predictions of two-field scalar-tensor theories invariant under dilatations. The results presented extend the predictions of the Higgs-dilaton model to a full class of theories defined by an underlying principle. In particular, I will show that when the field-derivative space in the Einstein frame is maximally symmetric during inflation, the inflationary predictions
are universal and independent of the details of the theory.

Primary author: Dr RUBIO, Javier (ITP Heidelberg)

Presenter: Dr RUBIO, Javier (ITP Heidelberg)

Session Classification: Parallel Session: Cosmology & Astroparticle Physics

Track Classification: Cosmology & Astroparticle Physics

Contribution ID: **19** Type: **not specified**

Rethinking baryon number conservation by black holes

Thursday, September 29, 2016 4:35 PM (15 minutes)

Standard folk-theorem arguments claim that global charges, such as baryon number, cannot be conserved by semiclassical black holes. We argue that the existence of black holes with classical skyrmion hair invalidates these standard arguments. By carefully analyzing the standard arguments based on a Gedankenexperiment in which a black hole
is seemingly-unable to return the baryon number that it swallowed, we identify inconsistencies in this reasoning, which does not take into the account neither the existence of skyrmion black holes nor the baryon/skyrmion correspondence. Using a refined Gedankenexperiment, we argue that one should rethink the option of baryon number conservation by semiclassical black holes and provide arguments in favor of baryon number conservation. If a black hole cannot destroy baryon number, this can have important phenomenological consequences.

Primary authors: Mr GUSSMANN, Alexander (Arnold-Sommerfeld-Center, LMU Munich); Prof. DVALI, Georgi (LMU Munich, MPI Munich, New-York university)

Presenter: Mr GUSSMANN, Alexander (Arnold-Sommerfeld-Center, LMU Munich)

Session Classification: Parallel Session: Cosmology & Astroparticle Physics

Track Classification: Cosmology & Astroparticle Physics

Contribution ID: **20** Type: **not specified**

Probing the geometry of BPS states with Spectral Networks

Wednesday, September 28, 2016 4:35 PM (20 minutes)

New relations between wall crossing invariants, such as the BPS monodromy, and various limits of superconformal indices of 4d N=2 theories have been recently proposed. For theories of class S on their Coulomb branches, spectral networks provide a way to compute BPS monodromies directly, in a neighborhood of the superconformal point. Several new results on BPS monodromies can be obtained in this way, bringing new insights into these correspondences.

Primary author: Mr LONGHI, Pietro (Uppsala University)

Presenter: Mr LONGHI, Pietro (Uppsala University)

Session Classification: Parallel Session: Strings & Mathematical Physics

Track Classification: String & Mathematical Physics

Contribution ID: **21** Type: **not specified**

High-energy scattering in N=4 super Yang-Mills and single-valued polylogs

Thursday, September 29, 2016 2:50 PM (20 minutes)

In this talk, I will describe the connection between the high-energy limit of the six-gluon scattering amplitude in N=4 super Yang-Mills theory and a certain class of single-valued polylogarithmic functions.
While the evaluation of the six-gluon amplitude to high loop orders in general kinematics is a very difficult problem, the amplitude in the multi-Regge regime is governed by a dispersion-like integral which is fully known even at finite coupling.
However, this dispersion-like integral is formulated in Fourier-Mellin space. Obtaining expressions in momentum space thus requires carrying out said integral which is tedious beyond the lowest loop orders.
I will show how an understanding of the mathematical structure of the single-valued polylogs to which the integral evaluates gives rise to an efficient and algorithmic evaluation of the amplitude and briefly mention extensions to higher-point amplitudes.

Primary author: SPRENGER, Martin (ETH Zürich)

Presenter: SPRENGER, Martin (ETH Zürich)

Session Classification: Parallel Session: Strings & Mathematical Physics

Track Classification: String & Mathematical Physics

Contribution ID: **22** Type: **not specified**

Can massive primordial black holes be the dark matter?

Wednesday, September 28, 2016 2:15 PM (15 minutes)

The recent detection by Advanced LIGO of gravitational waves (GW) from the merging of a binary black hole system sets new limits on the merging rates of massive primordial black holes (PBH) that could be identified to the dark matter in the Universe. If PBH are regrouped in clusters with a similar density to the one observed in ultra-faint dwarf galaxies, merging rates are comparable to aLIGO expectations. Massive PBH dark matter predicts the existence of thousands of those dwarf galaxies where star formation is unlikely because of gas accretion onto PBH, which would possibly provide a solution to the missing satellite and too-big-to-fail problems. Such PBH could be produced in the early Universe, due to the collapse of large density fluctuations generated during a phase of hybrid inflation. A model easily embedded in high-energy frameworks such as supersymmetry. aLIGO and future GW antennas could be able measure the abundance and mass distribution of PBH in the range 5 - 200 solar masses to 10% accuracy, which could help to reveal their nature, with profound implications for cosmology and high energy physics.

Primary author: Dr CLESSE, Sebatien (RWTH Aachen University)

Co-author: Prof. GARCIA-BELLIDO, Juan (IFT Madrid)

Presenter: Dr CLESSE, Sebatien (RWTH Aachen University)

Session Classification: Parallel Session: Cosmology & Astroparticle Physics

Track Classification: Cosmology & Astroparticle Physics

Contribution ID: **24** Type: **not specified**

Two-loop Bhabha Scattering at High Energy beyond Leading Power

Thursday, September 29, 2016 2:40 PM (20 minutes)

We present the evaluation of the two-loop $calO(m_e^2/s)$ contribution to the wide-angle high-energy electron-positron scattering in the double-logarithmic approximation.
The origin and the general structure of the power-suppressed
double logarithmic corrections are discussed.

Primary author: Dr ZERF, Nikolai (ITP University of Heidelberg)

Presenter: Dr ZERF, Nikolai (ITP University of Heidelberg)

Session Classification: Parallel Session: Particle Phenomenology - QCD & BSM

Track Classification: Particle Phenomenology

Contribution ID: **25** Type: **not specified**

Two-Loop Corrections to the Higgs Masses in the Complex MSSM

Thursday, September 29, 2016 2:20 PM (20 minutes)

The discovery of a Higgs-like particle at the LHC has triggered considerable ongoing effort to reveal its nature and properties. The mass of the particle is one of its basic properties; due to the high-precision mass measurement, higher-order calculations are necessary to make competitive predictions. Although with current experimental results the particle could be identified as the Standard Model Higgs boson, other explanations in extended models are possible. In the theoretically well motivated Minimal Supersymmetric Standard Model (MSSM) the discovered particle could be one state of a richer Higgs-boson spectrum.

I will present the most recent status of the Higgs-particle spectrum in the CP-violating MSSM in the Feynman-diagrammatic approach with non-trivial renormalization. The effect of new two-loop contributions of the order α_t α_b + α_b^2 + α_any α_s is discussed and compared with the previously known two-loop corrections.

Primary author: Dr PASSEHR, Sebastian (DESY)

Presenter: Dr PASSEHR, Sebastian (DESY)

Session Classification: Parallel Session: Particle Phenomenology 1a - Higgs & BSM

Track Classification: Particle Phenomenology

Contribution ID: **26** Type: **not specified**

Higgs instability during and after inflation

Thursday, September 29, 2016 3:15 PM (15 minutes)

Current Higgs boson and top quark data favour metastability of our vacuum which raises questions as to why the Universe has chosen an energetically disfavoured state and remained there during the primordial dynamics. In this talk I will point out that allowing a simple Higgs-inflaton coupling can explain why the Higgs ended up in the electroweak vacuum after inflation. I will show that this coupling is present in many realistic models of reheating and thus well motivated. I will also discuss the effects of the Higgs-inflaton coupling during the initial period of reheating, also known as preheating, where the sizable production of Higgs particles can induce large fluctuations of the Higgs field which may destabilize the electroweak vacuum.

Primary author: Mr ZATTA, Marco (University of Helsinki)

Presenter: Mr ZATTA, Marco (University of Helsinki)

Session Classification: Parallel Session: Cosmology & Astroparticle Physics

Track Classification: Cosmology & Astroparticle Physics

Contribution ID: **30** Type: **not specified**

Galactic sources: update information from gamma-rays experiments and implications for IceCube

Wednesday, September 28, 2016 4:30 PM (15 minutes)

In this talk, I'll show how updated information from gamma-rays experiments constrain the spectrum of the galactic sources previously detected by the Milagro collaboration.
I'll show the number of through-going muons expected from these sources at the IceCube detector and I'll discuss the statistical significance of each source as a function of the detector running time.
Moreover, I'll show also the constrains that could be set on the cut-off
energy and spectral index of the Milagro sources.

Primary author: Dr NIRO, Viviana (IFT UAM/CSIS and UAM)

Presenter: Dr NIRO, Viviana (IFT UAM/CSIS and UAM)

Session Classification: Parallel Session: Cosmology & Astroparticle Physics

Track Classification: Cosmology & Astroparticle Physics

Contribution ID: **31** Type: **not specified**

Structure of Kaehler potential for D-term inflationary attractor models

Thursday, September 29, 2016 4:50 PM (15 minutes)

Minimal chaotic models of D-term inflation predicts too large primordial tensor perturbations. Although it can be made consistent with observations utilizing higher order terms in the Kaehler potential, expansion is not controlled in the absence of symmetries. We comprehensively study the conditions of Kaehler potential for D-term plateau-type potentials and discuss its symmetry. They include the alpha-attractor model with a massive vector supermultiplet and its generalization leading to pole inflation of arbitrary order. We extend the models so that it can describe Coulomb phase, gauge anomaly is cancelled, and fields other than inflaton are stabilized during inflation. We also point out a generic issue for large-field D-term inflation that the masses of the non-inflaton fields tend to exceed the Planck scale.

Primary authors: NAKAYAMA, Kazunori (The University of Tokyo); SAIKAWA, Ken'ichi (DESY); YAMAGUCHI, Masahide (Tokyo Institute of Technology); TERADA, Takahiro (Asia Pacific Center for Theoretical Physics)

Presenter: SAIKAWA, Ken'ichi (DESY)

Session Classification: Parallel Session: Cosmology & Astroparticle Physics

Track Classification: Cosmology & Astroparticle Physics

Contribution ID: **33** Type: **not specified**

Leptogenesis from Oscillations of Heavy Neutrinos with Large Mixing Angles

Wednesday, September 28, 2016 4:15 PM (15 minutes)

The extension of the Standard Model by heavy right-handed neutrinos can simultaneously explain the observed neutrino masses via the seesaw mechanism and the baryon asymmetry of the Universe via leptogenesis. If the mass of the heavy neutrinos is below the electroweak scale, they may be found at LHCb, BELLE II, the proposed SHiP experiment or a future high-energy collider. In this mass range, the baryon asymmetry is generated via CP-violating oscillations of the heavy neutrinos during their production. We study the generation of the baryon asymmetry of the Universe in this scenario from first principles of non-equilibrium quantum field theory, including spectator processes and feedback effects. We eliminate several uncertainties from previous calculations and find that the baryon asymmetry of the Universe can be explained with larger heavy neutrino mixing angles, increasing the chance for an experimental discovery. For the limiting cases of fast and strongly overdamped oscillations of right-handed neutrinos, the generation of the baryon asymmetry can be calculated analytically up to corrections of order one.

Primary author: Mr KLARIĆ, Juraj (Technical University Munich)

Presenter: Mr KLARIĆ, Juraj (Technical University Munich)

Session Classification: Parallel Session: Cosmology & Astroparticle Physics

Track Classification: Cosmology & Astroparticle Physics

Contribution ID: **36** Type: **not specified**

Mordell-Weil Torsion in the Mirror of Multi-Sections

Wednesday, September 28, 2016 3:35 PM (15 minutes)

We give further evidence that genus-one fibers with multi-sections are mirror dual to fibers with Mordell-Weil torsion. In the physics of F-theory compactifications this implies a relation between models with a non-simply connected gauge group and those with discrete symmetries. We explicitly check this observation for torus fibers in two and three dimensional ambient spaces whereas the duality admits a combinatorial explanation for the first case. We comment on several new features of these models, such as self-dual fibers that realize models with quotient and discrete symmetries at the same time.

Primary authors: OEHLMANN, Paul-Konstantin (DESY); SCHIMANNEK, Thorsten (Bonn University)

Presenter: OEHLMANN, Paul-Konstantin (DESY)

Session Classification: Parallel Session: Strings & Mathematical Physics

Track Classification: String & Mathematical Physics

Contribution ID: **37** Type: **not specified**

Efficient calculation of cosmological neutrino clustering

Thursday, September 29, 2016 2:45 PM (15 minutes)

Within the next few years cosmological structure formation will be probed in greater detail than ever before by new and very large surveys, most notably EUCLID and LSST.
While this opens great possibilities for probing for example dark energy and the mass of neutrinos, it also puts very stringent requirements on theoretical calculations of cosmological observables, such as the matter power spectrum. In this regard, the treatment of massive neutrinos is particularly challenging both in N-body simulations and in linear theory Boltzmann codes.
In this talk I will present a new approximation to the third moment of the Boltzmann hierarchy and demonstrate that with this new approximation the neutrino power spectrum can be calculated with a precision of a few percent.
Then I will discuss an extremely efficient way of calculating the neutrino power spectrum in the regime of non-linear dark matter clustering: I will show that the derived neutrino power spectrum is consistent with what can be calculated in real space using N-body simulations.

Primary author: ARCHIDIACONO, Maria (RWTH Aachen University)

Presenter: ARCHIDIACONO, Maria (RWTH Aachen University)

Session Classification: Parallel Session: Cosmology & Astroparticle Physics

Track Classification: Cosmology & Astroparticle Physics

Contribution ID: **38** Type: **not specified**

Lepton-flavour violation in a Pati-Salam model with gauged flavour symmetry

Wednesday, September 28, 2016 3:00 PM (20 minutes)

Combining Pati-Salam (PS) and flavour symmetries in a renormalisable setup, we devise a scenario which produces realistic masses for the charged leptons. Flavour-symmetry breaking scalar fields in the adjoint representations of the PS gauge group are responsible for generating different flavour structures for up- and down-type quarks as well as for leptons. The model is characterised by new heavy fermions which mix with the Standard Model quarks and leptons. In particular, the partners for the third fermion generation induce sizeable sources of flavour violation. Focusing on the charged-lepton sector, we scrutinise the model with respect to its implications for lepton-flavour violating processes such as $\mu \to e\gamma$, $\mu \to 3e$ and muon conversion in nuclei.

Primary authors: LUHN, Christoph (Theoretische Physik 1 Elementarteilchenphysik Uni Siegen); MOCH, Paul (Theoretische Physik 1 Elementarteilchenphysik Uni Siegen); FELDMANN, Thorsten (Theoretische Physik 1 Elementarteilchenphysik Uni Siegen)

Presenter: MOCH, Paul (Theoretische Physik 1 Elementarteilchenphysik Uni Siegen)

Session Classification: Parallel Session: Particle Phenomenology 1b - BSM

Track Classification: Particle Phenomenology

Contribution ID: **39** Type: **not specified**

Wedge-local fields in interacting quantum field theories with bound states

Thursday, September 29, 2016 4:25 PM (20 minutes)

In the context of constructing interacting quantum field theories in the operator-algebraic approach, wedge-local fields play an important role. After the work of Lechner to construct factorizing scattering matrix models with scalar S-matrices without bound states, we recently extended this construction to the Z(N)-Ising model and the A_N-1 affine Toda field theories, namely models with a richer particle spectrum and which are believed to have bound states. This construction is done by exhibiting wedge-local fields which arise as a deformation of Lechner's fields with the so called "bound state operator". In this talk I will review the passages of this construction and explain the open problems.

Primary author: Dr CADAMURO, Daniela (Universität Göttingen)

Presenter: Dr CADAMURO, Daniela (Universität Göttingen)

Session Classification: Parallel Session: Strings & Mathematical Physics

Track Classification: String & Mathematical Physics

Contribution ID: **40** Type: **not specified**

Perspectives for tests of neutrino mass generation at the GeV scale: Experimental reach versus theoretical predictions

Wednesday, September 28, 2016 5:00 PM (15 minutes)

It has been shown that heavy neutral leptons (HNLs) can explain many phenomena seen in Nature such as the neutrino oscillation data, dark matter and the baryon asymmetry. Therefore, alot of theoretical and experimental effort has been put into this subject. I will discuss the parameter space reach of future experiments searching for HNLs at the GeV scale in terms of neutrino mass models with three HNL generations. I will focus on two classes of models: Generic assumptions and flavor symmetry-generated models.

Primary author: Mr RASMUSSEN, Rasmus (DESY)

Co-author: Dr WINTER, Walter (DESY)

Presenter: Mr RASMUSSEN, Rasmus (DESY)

Session Classification: Parallel Session: Cosmology & Astroparticle Physics

Track Classification: Cosmology & Astroparticle Physics

Contribution ID: **41** Type: **not specified**

Four-jet production in single- and double-parton scattering within high-energy factorisation

Wednesday, September 28, 2016 4:35 PM (20 minutes)

We present a phenomenological study of 4-jet production, calculated within high-energy factorization, including both contributions from single-parton and double-parton scattering. High-energy factorization causes a momentum inbalance in the final state, allowing for the description of observables at tree-level that would require next-to-leading order precision in collinear factorization. The momentum inbalance is caused by non-vanishing transverse momentum components for the initial-state partons which thus are off-shell. We will clarify how to define gauge invariant scattering amplitudes with off-shell partons, and how to calculate them efficiently.

Primary author: VAN HAMEREN, Andreas (IFJ PAN)

Presenter: VAN HAMEREN, Andreas (IFJ PAN)

Session Classification: Parallel Session: Particle Phenomenology - QCD

Track Classification: Particle Phenomenology

Contribution ID: **43** Type: **not specified**

Light from Dark (Matter) via Multi-Wavelength Synergies

Wednesday, September 28, 2016 2:30 PM (15 minutes)

A tremendous experimental effort is underway with the goal of delivering the first non- gravitational detection of dark matter (DM). Indeed, despite its huge abundance, very little is known about the true nature of DM, and the community is eager for new and innovative ideas able to finally pin down its properties. In this talk, I shall review how cross-correlations of astrophysical and cosmological observables have the real potential of detecting electromagnetic signals from annihilating/decaying DM particles. This is done by exploiting multi-wavelength synergies between gamma-ray experiments and optical/near-IR cosmological surveys, thanks to which we can disentangle the feeble gamma-ray signal expected from particle DM interactions from the overwhelming astrophysical background of unresolved gamma-ray sources. After having set the scene, I shall also present recent observational results.

Primary author: Dr STEFANO CAMERA, Stefano (Jodrell Bank Centre for Astrophysics, The University of Manchester)

Presenter: Dr STEFANO CAMERA, Stefano (Jodrell Bank Centre for Astrophysics, The University of Manchester)

Session Classification: Parallel Session: Cosmology & Astroparticle Physics

Track Classification: Cosmology & Astroparticle Physics

Contribution ID: **44** Type: **not specified**

The Schroedinger method as field theoretical model to describe structure formation

Thursday, September 29, 2016 3:00 PM (15 minutes)

We investigate the formation of a dark matter halo using an idea that is rooted in the correspondence between phase space distributions in classical and quantum mechanics. The dynamics of cold dark matter is governed by the Vlasov (or collisionless Boltzmann) equation whose nonlinearity is induced by gravity according to the Poisson equation. Determining the evolution of density and velocity demands solving a coupled hierarchy for the cumulants of the distribution function In the presence of long-range interaction, no consistent truncation is known apart from the pressureless fluid model which is incapable of describing halo formation due to the inability to generate higher cumulants dynamically. We introduce the Schrödinger method where dark matter is modeled as self-gravitating scalar field solving the Schrödinger-Poisson equation. Using the phase space formulation of quantum mechanics, we construct a distribution function that approximately solves the Vlasov-Poisson equation without truncation. We demonstrate that the Schrödinger method is capable of emulating the dynamics of halo formation while containing only two degrees of freedom, just like the pressureless fluid model. Based on this, we discuss how the Schrödinger method can guide further modeling based on solutions with finitely generated rather than finitely many cumulants.

Primary author: Dr UHLEMANN, Cora (Utrecht University)

Presenter: Dr UHLEMANN, Cora (Utrecht University)

Session Classification: Parallel Session: Cosmology & Astroparticle Physics

Track Classification: Cosmology & Astroparticle Physics

Contribution ID: **46** Type: **not specified**

A halo independent comparison of direct dark matter searches

Wednesday, September 28, 2016 3:15 PM (15 minutes)

In this work, we develop a method to compare results from various direct detection experiments without making assumptions on the velocity distribution of the dark matter particles in the Solar System. Furthermore, we consider the particular case when one of the experiments reports a positive signal, and we apply our method to investigate the compatibility of the DAMA claim with the null searches from other experiments.

Primary author: RAPPELT, Andreas (Technische Universität München)

Co-author: Prof. IBARRA, Alejandro (Technische Universität München)

Presenter: RAPPELT, Andreas (Technische Universität München)

Session Classification: Parallel Session: Cosmology & Astroparticle Physics

Track Classification: Cosmology & Astroparticle Physics

Contribution ID: **48** Type: **not specified**

Model-independent approach to gamma-ray spectral features in dark matter indirect searches

Wednesday, September 28, 2016 2:45 PM (15 minutes)

The observation of line-like signals of high-energy gamma rays is considered a discovery channel of dark matter.
Nevertheless, calculating the rate and the spectral shape associated to these processes is highly non-trivial and depends on the details of the underlying dark matter model.
I will argue that, in spite of this situation, there are a number of model-independent statements that can be drawn.
First, I will show that angular momentum considerations determine to a large extend the spectral features arising in dark matter annihilations into intermediary particles which subsequently produce photons via two-body decays. I illustrate this with the gamma-ray spectra generated by dark matter annihilating into hypothetical diphoton resonances.
If time allows, I will then discuss a systematic classification of the one-loop diagrams leading to dark matter annihilations into photon lines in an arbitrary model. I will argue that such classification can be used to greatly simplify the calculation of the corresponding cross sections.

Primary author: Dr GARCIA CELY, Camilo Alfredo (ULB)

Presenter: Dr GARCIA CELY, Camilo Alfredo (ULB)

Session Classification: Parallel Session: Cosmology & Astroparticle Physics

Track Classification: Cosmology & Astroparticle Physics

Contribution ID: **49** Type: **not specified**

Exploring the stop-bino coannihilation region with sbottom decays

Thursday, September 29, 2016 3:00 PM (20 minutes)

A light stop with mass almost degenerate with the lightest neutralino has important implications on naturalness and dark matter relic abundance, and is hard to search at colliders. In this paper, we study the potential of searching for such stop particles at the LHC from sbottom decays, focusing on two channels with final states 2l+met and 1b1l+met. We found that, if the lightest sbottom has mass around or below 1 TeV and has a significant branching ratio to decay to stop and W, which are favored by naturalness and Higgs mass, a stop almost degenerate with neutralino can be excluded up to about 500–600 GeV at the 13 TeV LHC with 300 fb^-1 data. The searches we propose are complementary to other SUSY searches at the LHC and could have the best sensitivity to the stop-bino coannihilation region. They can also be easily implemented in the existing searches at the LHC.

Primary authors: Dr AN, Haipeng (California Institute of Technology); Dr GU, Jiayin (DESY); Prof. WANG, Lian-Tao (University of Chicago)

Presenter: Dr GU, Jiayin (DESY)

Session Classification: Parallel Session: Particle Phenomenology - QCD & BSM

Track Classification: Particle Phenomenology

Contribution ID: **52** Type: **not specified**

Master Symmetry for Holographic Wilson Loops

Thursday, September 29, 2016 3:10 PM (20 minutes)

Recently, Wilson loops in strongly coupled AdS/CFT were found to be invariant under a curious one-parameter family of deformations. In this talk we analyze the nonlocal symmetry underlying this observation. We show that it acts as a raising operator on the Yangian charges and generates the spectral parameter of the model. We also speculate about the possibility to extend this symmetry beyond the strong-coupling limit.

Primary author: Dr LOEBBERT, Florian (Humboldt University Berlin)

Presenter: Dr LOEBBERT, Florian (Humboldt University Berlin)

Session Classification: Parallel Session: Strings & Mathematical Physics

Track Classification: String & Mathematical Physics

Contribution ID: **53** Type: **not specified**

The semi-classical energy of rotating Nambu-Goto strings

Wednesday, September 28, 2016 2:40 PM (20 minutes)

In the sense of perturbation theory around arbitrary classical solutions, the Nambu-Goto (NG) string can be consistently quantised as an effective theory for any dimension D of the target space [Comm. Math. Phys. 327 (2014) 779, with D. Bahns & K. Rejzner]. In this framework, we compute semi-classical corrections to the energy of rotating NG strings, using the locally covariant renormalisation scheme developed in the context of QFT on curved space-times by Hollands & Wald. For the open NG string, we find that the energy density diverges in a non-integrable way at the boundaries. Regularizing these divergences with boundary counterterms, we find the Regge intercept $a = 1 + (D-2)/24$. For the closed NG string, the energy density is finite and yields the same intercept. For this value of a, the NG string can not be quantised consistently in the covariant scheme for any dimension. [based on arXiv:1605.07928]

Primary author: ZAHN, Jochen (Universität Leipzig)

Presenter: ZAHN, Jochen (Universität Leipzig)

Session Classification: Parallel Session: Strings & Mathematical Physics

Track Classification: String & Mathematical Physics

Contribution ID: **55** Type: **not specified**

Strongly Coannihilating Dark Matter at the LHC

Wednesday, September 28, 2016 2:00 PM (20 minutes)

The coannihilation mechanism plays a crucial role in determining the DM relic abundance in a plethora of new physics models. Recently, a general classification of simplified models for this mechanism has been presented in the Coannihilation codex. In particular, the thermal relic abundance of a pure Standard Model singlet DM candidate can naturally be explained by coannihilation with a new colored partner in the dark sector. In these models direct and indirect detection modes are suppressed, however, LHC probes provide striking signatures. On the one hand, a mediator which connects the DM and its colored partner to the visible sector gives rise to a novel dijet resonance plus missing transverse energy final state. In the case where the mediator lies beyond LHC detection, self-annihilation of the colored partner through its strong interactions solely determines the relic abundance. The major LHC signature then is pair-production of the colored partner leading to jets plus missing transverse energy.

Primary author: Dr DE VRIES, Maikel (JGU Mainz)

Presenter: Dr DE VRIES, Maikel (JGU Mainz)

Session Classification: Parallel Session: Particle Phenomenology 1b - BSM

Track Classification: Particle Phenomenology

Contribution ID: **56** Type: **not specified**

Complex structures and zero-curvature equations for sigma-models

Wednesday, September 28, 2016 2:20 PM (20 minutes)

We construct zero-curvature representations for the equations of motion of a class of sigma-models with complex homogeneous target spaces, not necessarily symmetric. We show that in the symmetric case the proposed flat connection is gauge-equivalent to the conventional one.

Primary author: Dr BYKOV, Dmitri (Max-Planck-Institut fur Gravitationsphysik)

Presenter: Dr BYKOV, Dmitri (Max-Planck-Institut fur Gravitationsphysik)

Session Classification: Parallel Session: Strings & Mathematical Physics

Track Classification: String & Mathematical Physics

Contribution ID: **57** Type: **not specified**

Progress in constructing epsilon form of differential equations for master integrals with Fuchsia

Wednesday, September 28, 2016 5:35 PM (20 minutes)

We review Fuchsia: an open-source tool for constructing epsilon form of differential equations for Feynman master integrals based on the Lee algorithm. We show several examples of its application to various problems in Quantum Field Theory which require virtual and real momenta integration. We discuss current status of the project and possible extensions in the future.

Primary author: GITULIAR, Oleksandr (Institute of Nuclear Physics, Polish Academy of Sciences)

Presenter: GITULIAR, Oleksandr (Institute of Nuclear Physics, Polish Academy of Sciences)

Session Classification: Parallel Session: Particle Phenomenology - QCD

Track Classification: Particle Phenomenology

Contribution ID: **58** Type: **not specified**

Falsifying Baryogenesis Mechanisms through Observation of Lepton Number and Flavor Violation

Wednesday, September 28, 2016 5:30 PM (15 minutes)

Interactions that manifest themselves as lepton number violating processes at low energies in combination with sphaleron transitions typically erase any pre-existing baryon asymmetry of the Universe. We demonstrate in a model independent approach that the observation of neutrinoless double beta decay would impose a stringent constraint on mechanisms of high-scale baryogenesis, including leptogenesis scenarios. Further, we discuss the potential of the LHC to model independently exclude high-scale leptogenesis scenarios when observing lepton number violating processes. In combination with the observation of lepton flavor violating processes, we can further strengthen this argument, closing the loophole of asymmetries being stored in different lepton flavors.

Primary author: Dr HARZ, Julia (ILP / LPTHE Paris)

Co-authors: Dr DEPPISCH, Frank (University College London); Prof. PAES, Heinrich (TU Dortmund); Prof. HIRSCH, Martin (IFIC Valencia / University of Valencia); Dr HUANG, Weih-Chih (TU Dortmund)

Presenter: Dr HARZ, Julia (ILP / LPTHE Paris)

Session Classification: Parallel Session: Cosmology & Astroparticle Physics

Track Classification: Cosmology & Astroparticle Physics

Contribution ID: **60** Type: **not specified**

Soft and Coulomb resummation for squark and gluino production at the LHC

Thursday, September 29, 2016 2:40 PM (20 minutes)

I discuss the combined resummation of soft and Coulomb-gluon effects for the production of heavy coloured particles at NNLL accuracy, which includes contributions from spin-dependent non-relativistic potentials and so-called annihilation corrections.
I present results for squark and gluino pair production
at the LHC.

Primary author: Dr SCHWINN, Christian (RWTH Aachen)

Presenter: Dr SCHWINN, Christian (RWTH Aachen)

Session Classification: Parallel Session: Particle Phenomenology 1a - Higgs & BSM

Track Classification: Particle Phenomenology

Contribution ID: **61** Type: **not specified**

Top pair production with a jet with NLO QCD off-shell effects at the LHC

Thursday, September 29, 2016 4:25 PM (20 minutes)

Top quark physics is entering a precision era with the LHC Run II. A comprehensive study of top quark pair production in association with one hard jet in the di-lepton decay channel is presented for a center-of-mass energy of 13 TeV. The NLO QCD calculation takes into account all resonant and non-resonant and interference contributions for off-shell top quarks, and W and Z bosons. Theoretical uncertainties are addressed through an independent variation of the renormalization and factorization scales, where fixed-valued and dynamical scales have been investigated. In addition, the uncertainties induced by the parametrization of parton distribution functions have been addressed. Finally, a detailed comparison of the uncertainties for integrated and differential cross sections is presented.

Primary author: Mr KRAUS, Manfred (RWTH Aachen University)

Presenter: Mr KRAUS, Manfred (RWTH Aachen University)

Session Classification: Parallel Session: Particle Phenomenology - Top Physics

Track Classification: Particle Phenomenology

Contribution ID: **63** Type: **not specified**

Classification of maximally supersymmetric backgrounds in supergravity theories

Wednesday, September 28, 2016 3:20 PM (15 minutes)

We study maximally supersymmetric solutions of all gauged or deformed supergravity theories in D≥3 space-time dimensions. For vanishing background fluxes the space-time background has to be either Minkowski or anti-de Sitter. We derive a simple criterion for the existence of solutions with non-trivial fluxes and determine all supergravities that satisfy it. We show that their solutions coincide with those of the corresponding ungauged theories and conclude that the known list of maximally supersymmetric solutions is exhaustive.

Primary author: Mr LÜST, Severin (Universität Hamburg)

Presenter: Mr LÜST, Severin (Universität Hamburg)

Session Classification: Parallel Session: Strings & Mathematical Physics

Track Classification: String & Mathematical Physics

Contribution ID: **64** Type: **not specified**

Large-Charge Perturbation Theory

Thursday, September 29, 2016 2:00 PM (15 minutes)

I will introduce the basic concepts of Large-Charge Perturbation Theory (LCPT) in d+1 space-time dimensions.
Given a Quantum Field Theory with a globally conserved charge Q, LCPT aims at providing analytic insight to sectors, which remain inaccessible via ordinary perturbative methods, but where Q is assumed to be large.
To this end, the scalar O(2) model with ϕ^N self-interaction will be implemented as a toy-example.
I will construct the large-charge vacuum of this theory as a generalized coherent state and derive its effective potential at fixed (and large) charge Q.
Subsequently, we shall investigate the perturbative treatment of fluctuations around the large-Q vacuum proving the existence of a consistent "1/Q-expansion".

Primary author: Mr LOUKAS, Orestis (University of Bern)

Co-authors: Dr ORLANDO, Domenico (University of Bern); Dr ÁLVAREZ-GAUMÉ, Luis (CERN); Dr REFFERT, Susanne (University of Bern)

Presenter: Mr LOUKAS, Orestis (University of Bern)

Session Classification: Parallel Session: Strings & Mathematical Physics

Track Classification: String & Mathematical Physics

Contribution ID: **65** Type: **not specified**

Shape dependence of holographic Rényi entropy in general dimensions

Thursday, September 29, 2016 3:30 PM (15 minutes)

Rényi entropies, and entanglement entropy in particular, are popular measures of entanglement in quantum theories. We present a holographic method for computing the response of Rényi entropies in conformal field theories to small shape deformations around a flat (or spherical) entangling surface. Our strategy is based on general properties of conformal field theories in the presence of defects, and can be applied to the study of other extended operators in holographic CFTs. We present numerical and analytical results valid for the holographic duals of Einstein and Gauss-Bonnet gravity in various dimensions.

Primary author: MEINERI, Marco (EPFL)

Presenter: MEINERI, Marco (EPFL)

Session Classification: Parallel Session: Strings & Mathematical Physics

Track Classification: String & Mathematical Physics

Contribution ID: **66** Type: **not specified**

Unifying inflation with the axion, dark matter, baryogenesis and the seesaw mechanism

Thursday, September 29, 2016 2:00 PM (15 minutes)

I will describe a minimal extension of the Standard Model of particle physics that accounts for inflation, dark matter, baryogenesis,
the smallness of neutrino masses and solves the strong CP problem, with a new physics scale around ~10^11 GeV.

Primary author: BALLESTEROS, Guillermo (IPhT CEA - Saclay)

Presenter: BALLESTEROS, Guillermo (IPhT CEA - Saclay)

Session Classification: Parallel Session: Cosmology & Astroparticle Physics

Track Classification: Cosmology & Astroparticle Physics

Contribution ID: **67** Type: **not specified**

Crystalline Confined Phases in Lattice Gauge Theories

Thursday, September 29, 2016 2:20 PM (20 minutes)

In the Wilson formulation, lattice gauge theories with compact gauge
group are confining, at least in the strong coupling limit. In addition, the ground state usually preserves discrete symmetries such as translational and charge conjugation symmetry. In this talk, we consider generalized lattice gauge theories: quantum link models and self-adjoint extensions of Wilson-type theories in (2+1)-dimensions, which in addition to being confined, also spontaneously break charge conjugation or lattice translation invariance, thus giving rise to exotic crystalline confined phases. Qualitatively new phenomena, such as the fractionalization of the fundamental flux unit, can also be observed in these quantum link models, and may be observable in quantum simulations using, quantum circuits or ultracold atoms in an optical lattice.

Primary author: Dr BANERJEE, Debasish (Deutsches Elektronen Synchrotron DESY, Zeuthen)

Presenter: Dr BANERJEE, Debasish (Deutsches Elektronen Synchrotron DESY, Zeuthen)

Session Classification: Parallel Session: Particle Phenomenology - QCD & BSM

Track Classification: Particle Phenomenology

Contribution ID: **69** Type: **not specified**

Rethinking Higgs mass stability bounds

Thursday, September 29, 2016 2:00 PM (20 minutes)

We investigate nonperturbative renormalization group flows of various Higgs-Yukawa models mimicking the Higgs sector of the standard model. We reanalyze the conventional arguments that relate a lower bound for the Higgs mass with vacuum stability in the framework of the functional renormalization group as well as in the light of exact results for the regularized fermion determinant. In both cases, we find no indication for vacuum instability nor metastability induced by top fluctuations if the cutoff is kept finite but arbitrary for standard bare actions which are perturbatively renormalizable.
For the class of standard bare potentials of quartic type at a given ultraviolet cutoff scale, we show that a finite infrared Higgs mass range emerges naturally from the RG flow itself. Higgs masses outside the resulting bounds cannot be connected to any conceivable set of bare parameters in this standard model quartic class. A lower bound for the Higgs mass arises from the requirement of a well-defined partition function, i.e., stability of the bare potential. This consistency bound can, however, be relaxed considerably by more general forms of the bare potential without necessarily introducing new metastable minima. We identify a simple renormalization group mechanism for this diminishing of the lower bound. Thus, Higgs masses smaller than the conventional infrared window do not necessarily require new physics at low scales or give rise to instability problems.

Primary author: SONDENHEIMER, René (TPI FSU Jena)

Presenter: SONDENHEIMER, René (TPI FSU Jena)

Session Classification: Parallel Session: Particle Phenomenology 1a - Higgs & BSM

Track Classification: Particle Phenomenology

Contribution ID: **70** Type: **not specified**

Metastability, Chaotic Inflation, and Primordial Black Holes

Thursday, September 29, 2016 2:30 PM (15 minutes)

We revisit the compatibility between chaotic inflation, which provides a natural solution to the initial condition problem, and the metastable electroweak vacuum, which is suggested by the results of the LHC and the current mass measurements of top quark and Higgs boson. It is known that chaotic inflation poses a threat to the stability of the electroweak vacuum because it easily generates large Higgs fluctuations during inflation or preheating and triggers the catastrophic vacuum decay. In this talk, we would like to explain a simple cosmological solution in which the vacuum is stabilized during chaotic inflation, preheating and afterwards. This simple solution naturally predicts formation of primordial black holes. We find interesting parameter regions where the present dark matter density is provided by them. Gravitational waves could be used as an interesting probe. Also, the thermal leptogensis can be accommodated in our scenario.

Primary author: Dr MUKAIDA, Kyohei (Kavli IPMU)

Co-authors: Prof. KAWASAKI, Masahiro (ICRR); Prof. YANAGIDA, T. Tsutomu (Kavli IPMU)

Presenter: Dr MUKAIDA, Kyohei (Kavli IPMU)

Session Classification: Parallel Session: Cosmology & Astroparticle Physics

Track Classification: Cosmology & Astroparticle Physics

Contribution ID: **71** Type: **not specified**

Minkowski 3-forms and Axion Monodromy in String Theory

Wednesday, September 28, 2016 4:15 PM (20 minutes)

Axion monodromy is a promising proposal to achieve a transplanckian field range for an axion in string theory. These models are better described in terms of a Minkowski 3-form field which couples linearly to the axion, in the Kaloper-Sorbo fashion. We highlight the differences between this simple effective theory and the structure actually obtained from string theory. We show that all the RR and NS axion dependence of the flux Type II scalar potential appears through the said 3-forms. However, the presence of multiple 3-forms and the mixing with other (non-axionic) moduli makes necessary to revisit the arguments regarding perturbative control and backreaction, which indeed might reduce the effective field range. We also show the constraints on the field range coming from the Weak Gravity Conjecture when applied to these 3-forms, and the implications for large field inflation and the relaxion proposal to the EW hierarchy problem.

Primary author: Dr VALENZUELA, Irene (MPI, Munich)

Co-author: Prof. IBANEZ, Luis (IFT Madrid)

Presenter: Dr VALENZUELA, Irene (MPI, Munich)

Session Classification: Parallel Session: Strings & Mathematical Physics

Track Classification: String & Mathematical Physics

Contribution ID: **72** Type: **not specified**

Rigid Superconformal Field Theories in three dimensions

Wednesday, September 28, 2016 5:15 PM (15 minutes)

I'll talk about my work with J. Distler (to appear) in which we study a class of 3d N=4 superconformal field theories and their mass deformations. We perform this study by establishing a relation between the geometry of the vacuum moduli spaces of these theories and (a refined version of) the "Theory of sheets" which is an important subject in Geometric Representation Theory. This realizes in a precise way an earlier proposal of Chacaltana-Distler-Tachikawa about such a relationship. These three dimensional theories are related to the codimension two (or four dimensional) defects of the six dimensional (0,2) theory of type A,D,E (sometimes called theory X[j]) by dimensional reduction. Understanding the mass deformations of these three dimensional theories is the first step in understanding the mass deformations of a general class S theory. One of the surprises that arise in our study is the existence of Rigid N=4 SCFTs in three dimensions. These are non-trivial SCFTs that do not admit an ordinary mass deformation. I'll describe the Coulomb and Higgs branches of Rigid SCFTs and the implications of their existence for the study of mass deformations.

Primary authors: Dr BALASUBRAMANIAN, Aswin (DESY and Univ of Hamburg); Prof. DISTLER, Jacques (University of Texas at Austin)

Presenter: Dr BALASUBRAMANIAN, Aswin (DESY and Univ of Hamburg)

Session Classification: Parallel Session: Strings & Mathematical Physics

Track Classification: String & Mathematical Physics

Contribution ID: **75** Type: **not specified**

Black holes in the lab

Thursday, September 29, 2016 4:20 PM (15 minutes)

Black holes possess a wide range of rather peculiar properties, many of them in connection with their ability to process, store and release information. I explore the possibility that the physical origin of these properties is quantum criticality. To this end, I will demonstrate that simple Bose condensates exhibit a plethora of black hole like properties. This includes trapping, baldness, evaporation, entropy, scrambling and the breakdown of semiclassical physics and allows for the exciting possibility to test black hole information processing in labs. It can also serve as a powerful guideline to a quantum field theoretical understanding of black holes.

Primary author: Dr WINTERGERST, Nico (Stockholm University)

Presenter: Dr WINTERGERST, Nico (Stockholm University)

Session Classification: Parallel Session: Cosmology & Astroparticle Physics

Track Classification: Cosmology & Astroparticle Physics

Contribution ID: **77** Type: **not specified**

Flavor Cosmology: Dynamical Yukawas in the Froggatt-Nielsen Mechanism

Wednesday, September 28, 2016 4:45 PM (15 minutes)

If the Standard Model Yukawa couplings varied in the early universe and started with order one values before electroweak symmetry breaking, the CP violation associated with the CKM matrix could be the origin of the matter-antimatter asymmetry. The large effective Yukawa couplings which lead to the enhanced CP violation can also help in achieving a strong first-order electroweak phase transition. In this talk, I will discuss the implementation of dynamical Yukawa couplings in the context of the Froggatt–Nielsen mechanism.

Primary author: Dr BALDES, Iason (DESY)

Presenter: Dr BALDES, Iason (DESY)

Session Classification: Parallel Session: Cosmology & Astroparticle Physics

Track Classification: Cosmology & Astroparticle Physics

Contribution ID: **78** Type: **not specified**

Beyond complex Langevin equations

Thursday, September 29, 2016 5:00 PM (20 minutes)

A positive representation for an arbitrary complex, gaussian weight is derived and used to construct a statistical formulation of gaussian path integrals directly in the Minkowski time. The positivity of Minkowski weights is achieved by doubling the number of real variables. The continuum limit of the new representation exists only if some of the additional couplings tend to infinity and are tuned in a specific way. The construction is then successfully applied to three quantum mechanical examples including a particle in a constant magnetic field – a simplest prototype of a Wilson line. Further generalizations are shortly discussed and an intriguing interpretation of new variables is alluded to.

Primary author: WOSIEK, Jacek (Jagellonian University)

Presenter: WOSIEK, Jacek (Jagellonian University)

Session Classification: Parallel Session: Strings & Mathematical Physics

Track Classification: String & Mathematical Physics

Contribution ID: **80** Type: **not specified**

The strong coupling of three flavor QCD

Wednesday, September 28, 2016 5:15 PM (20 minutes)

I will present the ALPHA collaboration's latest calculation of the
Lambda parameter of QCD. Our method relies
on experimental inputs of low energy quantities like pseudo-scalar
decay constants only. The scale dependence of a coupling in a finite volume
renormalization scheme is computed non-perturbatively
in lattice QCD over many orders of magnitude
in the energy scale. At high energies perturbation theory is safely
applied to obtain the Lambda parameter in any scheme.

Primary authors: Dr RAMOS, Alberto (CERN); Dr SIMMA, Hubert (DESY); Dr BRUNO, Mattia (BNL); Dr DALLA BRIDA, Mattia (DESY); Dr FRITZSCH, Patrick (UAM, Madrid); Prof. SOMMER, Rainer (DESY); Dr SCHAEFER, Stefan (DESY); Prof. SINT, Stefan (Trinity College, Dublin); Dr KORZEC, Tomasz (Bergische Universität Wuppertal)

Presenter: Dr KORZEC, Tomasz (Bergische Universität Wuppertal)

Session Classification: Parallel Session: Particle Phenomenology - QCD

Track Classification: Particle Phenomenology

Contribution ID: **81** Type: **not specified**

Testing keV sterile neutrino dark matter in future direct detection experiments

Wednesday, September 28, 2016 5:15 PM (15 minutes)

We determine constraints on sterile neutrino warm dark matter through direct detection experiments, taking XENON100, XENON1T and DARWIN as example. While not competitive with astrophysical constraints from X-ray data, the constraints are the first direct laboratory bounds on sterile neutrino warm dark matter, and will be in some parts of parameter space the strongest limits on keV-scale neutrinos.

Primary author: Mr CAMPOS, Miguel (Max-Planck-Institut für Kernphysik)

Co-author: Dr RODEJOHANN, Werner (Max-Planck-Institut für Kernphysik)

Presenter: Mr CAMPOS, Miguel (Max-Planck-Institut für Kernphysik)

Session Classification: Parallel Session: Cosmology & Astroparticle Physics

Track Classification: Cosmology & Astroparticle Physics

Contribution ID: **82** Type: **not specified**

Realizing the Relaxion with N-site Models

Wednesday, September 28, 2016 3:20 PM (20 minutes)

Relaxion models are an interesting new avenue to explain the radiative stability of the Standard Model scalar sector. They require very large field excursions, which are difficult to generate in a consistent UV completion and to reconcile with the compact field space of the relaxion. We propose an N-site model which naturally generates the large decay constant needed to address these issues. Our model offers distinct advantages with respect to previous proposals: the construction involves non-abelian fields, allowing for controlled high energy behaviour and more model building possibilities, both in particle physics and inflationary models, and also admits a continuum limit when the number of sites is large, which may be interpreted as a warped extra dimension.

Primary authors: MACHADO, Camila (IFT, Unesp); DE LIMA, Leonardo (IFT, Unesp); FONSECA, Nayara (DESY); MATHEUS, Ricardo (IFT, Unesp)

Presenter: FONSECA, Nayara (DESY)

Session Classification: Parallel Session: Particle Phenomenology 1b - BSM

Track Classification: Particle Phenomenology

Contribution ID: **86** Type: **not specified**

Z-theory — non-linear sigma model amplitudes and more from open strings

Thursday, September 29, 2016 2:30 PM (20 minutes)

In this talk we derive the tree-level S-matrix of the effective theory of Goldstone bosons known as the non-linear sigma model (NLSM) from string theory. This novel connection relies on a recent realization of tree-level open-superstring S-matrix predictions as a double copy of super-Yang–Mills theory with Z-theory — the collection of putative scalar effective field theories encoding all the alpha'-dependence of the open superstring.
Here we identify the color-ordered amplitudes of the NLSM as the low-energy limit of abelian Z-theory. This realization also provides natural higher-derivative corrections to the NLSM amplitudes arising from higher powers of alpha' in the abelian Z-theory amplitudes, and through double copy also to Born–Infeld and Volkov–Akulov theories. The Kleiss–Kuijf and Bern–Carrasco–Johansson relations obeyed by Z-theory amplitudes thereby apply to all alpha'-corrections of the NLSM. As such we naturally obtain a cubic-graph parameterization for the abelian Z-theory predictions whose kinematic numerators obey the duality between color and kinematics to all orders in alpha'.

Primary author: Dr SCHLOTTERER, Oliver (AEI Potsdam)

Co-authors: Dr MAFRA, Carlos (University of Southampton); Dr CARRASCO, John-Joseph (CEA Saclay)

Presenter: Dr SCHLOTTERER, Oliver (AEI Potsdam)

Session Classification: Parallel Session: Strings & Mathematical Physics

Track Classification: String & Mathematical Physics

Contribution ID: **87** Type: **not specified**

Green-Schwarz superstring on the lattice

Thursday, September 29, 2016 4:45 PM (15 minutes)

We consider possible discretizations for a gauge-fixed Green-Schwarz action of Type IIB superstring. We use them for measuring the action, from which we extract the cusp anomalous dimension of planar N=4 SYM as derived from AdS/CFT, as well as the mass of the two AdS excitations transverse to the relevant null cusp classical string solution. For both the observables, we find a good agreement for large g, which is the perturbative regime of the sigma-model. For smaller values of g, the expectation value of the action exhibits a deviation compatible with the presence of quadratic divergences. After their non-perturbative subtraction the continuum limit can be taken, and suggests a qualitative agreement with the non-perturbative expectation from AdS/CFT.

Primary author: Dr BIANCHI, Lorenzo (Hamburg University)

Co-author: Dr FORINI, Valentina (Humboldt University Berlin)

Presenter: Dr BIANCHI, Lorenzo (Hamburg University)

Session Classification: Parallel Session: Strings & Mathematical Physics

Track Classification: String & Mathematical Physics

Contribution ID: **88** Type: **not specified**

Vector boson pair production in gluon fusion including interference effects with off-shell Higgs at the LHC

Wednesday, September 28, 2016 2:20 PM (20 minutes)

We will report on the recent calculation of the NLO QCD corrections to vector boson pair production in gluon fusion, focussing in particular on its interference with the Higgs signal. In particular, as it was shown by Caola and Melnikov, assessing the impact of the interference on the signal and background cross sections in the high energy tail (i.e. for an off-shell Higgs) is crucial to put stringent constraints on the width of the Higgs. This, in turn, is important to allow precise measurements of the Higgs couplings. Moreover, studying the interference at high invariant masses is very interesting to confirm the EWSB mechanism; the interference is, in fact, expected to be strong and destructive, as the Higgs boson is supposed to unitarize the scattering amplitudes of massive fermions and gauge bosons.

Primary author: TANCREDI, Lorenzo (KIT Karlsruhe)

Presenter: TANCREDI, Lorenzo (KIT Karlsruhe)

Session Classification: Parallel Session: Particle Phenomenology 1a - Higgs & BSM

Track Classification: Particle Phenomenology

Contribution ID: **90** Type: **not specified**

Multicomponent WIMP Dark Matter from gauge symmetries

Wednesday, September 28, 2016 3:30 PM (15 minutes)

Simple single component WIMP Dark Matter (DM) models are under pressure from direct detection (DD). This is related to the relation between annihilation- and DD cross-section in such models. By contrast, multicomponent WIMP DM models leave open a large part of the parameter space and allow for a very rich phenomenology. We study these issues using the example of a UV complete framework containing both scalar and vector WIMPs. This model arises from hidden gauge symmetries, connected to the Standard model with a Higgs portal.

Primary author: Dr GROSS, Christian (Helsinki University)

Presenter: Dr GROSS, Christian (Helsinki University)

Session Classification: Parallel Session: Cosmology & Astroparticle Physics

Track Classification: Cosmology & Astroparticle Physics

Contribution ID: **92** Type: **not specified**

A stable vacuum: why we found no SUSY

Thursday, September 29, 2016 2:15 PM (15 minutes)

The discovery of the Higgs boson puts a severe constraint on the available parameter space in any SUSY model. In the MSSM, a 125 GeV Higgs together with relatively light stops needs a very large stop mixing, therefore large trilinear terms in the scalar potential. Those are known to destabilize the electroweak ground state and induce a true vacuum in association with squark vevs. Previous analyses of vacuum stability in the MSSM usually follow rather arbitrary constraints in the field space configuration. Relaxing the bounds on field alignment, we find distinct excluded regions and constrain the allowed parameters even further by imposing the correct light Higgs mass. As result, generically squark masses in the multi TeV regime are needed to avoid an unstable vacuum - a result with agrees with the observation of no hints of SUSY so far.

Presenter: HOLLIK, Wolfgang Gregor (DESY)

Session Classification: Parallel Session: Cosmology & Astroparticle Physics

Track Classification: Cosmology & Astroparticle Physics

Contribution ID: **93** Type: **not specified**

Exceptional F(4) Higher-Spin Theory in AdS(6) at One-Loop and other Tests of Duality

Wednesday, September 28, 2016 2:00 PM (20 minutes)

We study the higher-spin gauge theory in six-dimensional anti-de Sitter space AdS6 that is based on the exceptional Lie superalgebra F(4). The relevant higher-spin algebra was constructed in arXiv:1409.2185 [hep-th]. We determine the spectrum of the theory and show that it contains the physical fields of the Romans F(4) gauged supergravity. The full spectrum consists of an infinite tower of unitary supermultiplets of F(4) which extend the Romans multiplet to higher spins plus a single short supermultiplet.
Motivated by applications to this novel supersymmetric higher-spin theory as well as to other theories, we extend the known one-loop tests of AdS/CFT duality in various directions. The spectral zeta-function is derived for the most general case of fermionic and mixed-symmetry fields, which allows one to test the Type-A and B theories and supersymmetric extensions thereof in any dimension. We also study higher-spin doubletons and partially-massless fields. While most of the tests are successfully passed, the Type-B theory in all even dimensional anti-de Sitter spacetimes presents an interesting puzzle: the free energy as computed from the bulk is not equal to that of the free fermion on the CFT side, though there is some systematics to the discrepancy.

Presenter: SKVORTSOV, Evgeny

Session Classification: Parallel Session: Strings & Mathematical Physics

Track Classification: String & Mathematical Physics

Contribution ID: **94** Type: **not specified**

The Higgs boson as a five-dimensional gauge field

Wednesday, September 28, 2016 3:00 PM (20 minutes)

We present a non-perturbative study of a five-dimensional Gauge-Higgs Unification model on the lattice using Monte Carlo simulations.
We find a region in the Higgs phase where the ratio of the Higgs to the gauge boson mass is like in the Standard Model. In the same region we observe localization to four dimensions. Despite the non existence of a second order phase transition, cut-off effects are found to be small allowing a prediction of the energy of excited states.

Primary author: KNECHTLI, Francesco (Univ. Wuppertal)

Presenter: KNECHTLI, Francesco (Univ. Wuppertal)

Session Classification: Parallel Session: Particle Phenomenology 1a - Higgs & BSM

Track Classification: Particle Phenomenology

Contribution ID: **95** Type: **not specified**

Differential Higgs Boson Pair Production at NNLO in QCD

Wednesday, September 28, 2016 2:00 PM (20 minutes)

Primary author: LINDERT, Jonas (Zurich University)

Presenter: LINDERT, Jonas (Zurich University)

Session Classification: Parallel Session: Particle Phenomenology 1a - Higgs & BSM

Track Classification: Particle Phenomenology

Contribution ID: **96** Type: **not specified**

Tackling differential distributions for Higgs production at higher orders

Wednesday, September 28, 2016 2:40 PM (20 minutes)

Primary author: LIONETTI, Simone (ETH Zurich)

Presenter: LIONETTI, Simone (ETH Zurich)

Session Classification: Parallel Session: Particle Phenomenology 1a - Higgs & BSM

Track Classification: Particle Phenomenology

Contribution ID: **97** Type: **not specified**

LHC Benchmark Scenarios for the Real Higgs Singlet Extension of the Standard Model

Wednesday, September 28, 2016 3:20 PM (20 minutes)

Primary author: ROBENS, Tania (TU Dresden)

Presenter: ROBENS, Tania (TU Dresden)

Session Classification: Parallel Session: Particle Phenomenology 1a - Higgs & BSM

Track Classification: Particle Phenomenology

Contribution ID: **98** Type: **not specified**

A comprehensive approach to dark matter studies: exploration of simplified top-philic models

Wednesday, September 28, 2016 2:20 PM (20 minutes)

Primary author: HEISIG, Jan (RWTH Aachen University)

Presenter: HEISIG, Jan (RWTH Aachen University)

Session Classification: Parallel Session: Particle Phenomenology 1b - BSM

Track Classification: Particle Phenomenology

Contribution ID: **99** Type: **not specified**

Distinguishing Dirac and Majorana Sterile Neutrinos at LHC

Wednesday, September 28, 2016 2:40 PM (20 minutes)

Primary author: WANG, Kechen (DESY)

Presenter: WANG, Kechen (DESY)

Session Classification: Parallel Session: Particle Phenomenology 1b - BSM

Track Classification: Particle Phenomenology

Contribution ID: **100** Type: **not specified**

Recommendations for PDF usage in LHC predictions

Wednesday, September 28, 2016 4:55 PM (20 minutes)

Primary author: GARZELLI, Maria Vittoria (Hamburg University)

Presenter: GARZELLI, Maria Vittoria (Hamburg University)

Session Classification: Parallel Session: Particle Phenomenology - QCD

Track Classification: Particle Phenomenology

Contribution ID: **101** Type: **not specified**

CheckMATE: Confronting New Physics Model with LHC Data

Thursday, September 29, 2016 3:00 PM (20 minutes)

Primary author: SCHMEIER, Daniel (Bonn University)

Presenter: SCHMEIER, Daniel (Bonn University)

Session Classification: Parallel Session: Particle Phenomenology 1a - Higgs & BSM

Track Classification: Particle Phenomenology

Contribution ID: **102** Type: **not specified**

Prospects for Supersymmetry after current LHC results

Thursday, September 29, 2016 3:20 PM (20 minutes)

Primary author: BAGNASCHI, Emanuele A. (DESY)

Presenter: BAGNASCHI, Emanuele A. (DESY)

Session Classification: Parallel Session: Particle Phenomenology 1a - Higgs & BSM

Track Classification: Particle Phenomenology

Contribution ID: **103** Type: **not specified**

SUSY parameters from higgsino measurements in high-energy electron-positron collisions

Thursday, September 29, 2016 3:20 PM (20 minutes)

Primary author: LEHTINEN, Suvi-Leena (DESY)

Presenter: LEHTINEN, Suvi-Leena (DESY)

Session Classification: Parallel Session: Particle Phenomenology - QCD & BSM

Track Classification: Particle Phenomenology

Contribution ID: **104** Type: **not specified**

Probing the electroweak interactions of top quarks at the LHC

Thursday, September 29, 2016 4:05 PM (20 minutes)

Primary author: SCHULZE, Markus (HU Berlin)

Presenter: SCHULZE, Markus (HU Berlin)

Session Classification: Parallel Session: Particle Phenomenology - Top Physics

Track Classification: Particle Phenomenology

Contribution ID: **105** Type: **not specified**

NLO+PS for ttbar and Wt production and decay including non-resonant and interference effects

Thursday, September 29, 2016 4:45 PM (20 minutes)

Primary author: LINDERT, Jonas (Zurich University)

Presenter: LINDERT, Jonas (Zurich University)

Session Classification: Parallel Session: Particle Phenomenology - Top Physics

Track Classification: Particle Phenomenology

Contribution ID: **106** Type: **not specified**

Observing the Top Energy Asymmetry at the LHC

Thursday, September 29, 2016 5:05 PM (20 minutes)

Primary author: WESTHOFF, Susanne (Heidelberg University)

Presenter: WESTHOFF, Susanne (Heidelberg University)

Session Classification: Parallel Session: Particle Phenomenology - Top Physics

Track Classification: Particle Phenomenology

Contribution ID: **107** Type: **not specified**

Structure constants in N=4 SYM from the OPE and from integrability

Wednesday, September 28, 2016 3:00 PM (20 minutes)

Three-point functions of generic gauge invariant composite operators in N=4 SYM are very hard to construct in higher-order weak-coupling perturbation theory. On the other hand, three-point functions of half-BPS operators are non-renormalised, and guided by symmetry principles the integrands for their four-point functions can be constructed to high loop order at least in the planar theory. We sketch this approach and explain how the three-point couplings of two half-BPS and one twist two operator can be found by a double OPE limit on four-point functions. We present new results at four loops obtained by the technique of asymptotic expansions. Second, we discuss the calculation of the same class of structure constants at three loops using the recently proposed hexagon formalism.

Presenter: EDEN, Burkhard

Session Classification: Parallel Session: Strings & Mathematical Physics

Track Classification: String & Mathematical Physics

Contribution ID: **108** Type: **not specified**

Quantization of super-Teichmuller theory

Wednesday, September 28, 2016 5:30 PM (15 minutes)

Primary author: AGHAEI, Nezhla (DESY)

Presenter: AGHAEI, Nezhla (DESY)

Session Classification: Parallel Session: Strings & Mathematical Physics

Track Classification: String & Mathematical Physics

Contribution ID: **109** Type: **not specified**

The N=2 superconformal bootstrap

Thursday, September 29, 2016 4:05 PM (20 minutes)

Primary author: LIENDO, Pedro (DESY)

Presenter: LIENDO, Pedro (DESY)

Session Classification: Parallel Session: Strings & Mathematical Physics

Track Classification: String & Mathematical Physics

Contribution ID: **110** Type: **not specified**

Welcome

Tuesday, September 27, 2016 2:00 PM (10 minutes)

Presenter: ARUTYUNOV, Gleb

Session Classification: Welcome

Contribution ID: **111** Type: **not specified**

UV Completion of Some UV Fixed Points

Tuesday, September 27, 2016 2:10 PM (30 minutes)

We start by reviewing UV completion of the Gross-Neveu model in dimensions between two and four via the Gross-Neveu-Yukawa model,
which is a multi-flavor Yukawa theory. We discuss the operator scaling dimensions and the sphere free energy for these Conformal Field Theories.
The case of a single two-component Majorana fermion is special in that the theory appears to flow to a CFT with emergent supersymmetry, and we provide
evidence for this using 4-epsilon expansions. We also discuss the O(N) symmetric scalar theory in dimensions between four and six, where it appears to be
unitary to all orders in the 1/N expansion, and propose its UV completion in terms of a cubic theory.
In 6-epsilon dimensions this O(N) symmetric cubic theory has an IR stable fixed point for N>1038. We conclude
with comments on continuation of this theory to five dimensions.

Presenter: KLEBANOV, Igor

Session Classification: Plenary Session

Contribution ID: **112** Type: **not specified**

The Yang-Mills gradient flow – a new tool in non-perturbative QFT

Tuesday, September 27, 2016 2:50 PM (30 minutes)

The Yang-Mills gradient flow provides new insight into the dynamics of non-Abelian gauge theories and has become a widely used tool in lattice QCD. In this talk, the theoretical foundation of the flow is reviewed and some of its applications are briefly described.

Presenter: LUESCHER, Martin

Session Classification: Plenary Session

Contribution ID: **113** Type: **not specified**

Numerical Stochastic Perturbation Theory

Tuesday, September 27, 2016 3:30 PM (30 minutes)

Perturbation theory for lattice regularization of field theory is known to be a quite hard subject and this holds true in particular for lattice gauge theory. In the 90's the numerical implementation of stochastic perturbation theory (NSPT) was introduced. NSPT can not only make perturbative computations on the lattice (in some cases much) easier, but also enable the computation of extremely high orders. We will discuss foundations and key features of NSPT and review a few significant computations which were made possible by NSPT.

Presenter: DI RENZO, Francesco

Session Classification: Plenary Session

Contribution ID: **114** Type: **not specified**

C-theorems and Entanglement Entropy

Tuesday, September 27, 2016 4:40 PM (30 minutes)

A great part of the problem of understanding the structure of the space of quantum field theories (QFT) is arguably reduced to the one of classifying possible critical points. In this picture, the theories with mass scales are obtained by perturbing critical points and following the renormalization group (RG) trajectories. However, interestingly, in the flow not all critical points can be joined with each other: there are constraints provided by c-theorems. These state that certain c-charge decreases from the UV to the IR fixed points showing the irreversible character of the RG flow.

The idea of relating the c-theorem with entanglement entropy is motivated by the result that central charges can be identified as coefficients of entanglement entropy for even dimensional space-time theories. In this scenario, the coefficient of the logarithmic term and the constant term in the entropy were suggested as c-functions, for even and odd dimensional theories respectively. We will discuss the d = 2 and 3 cases, where this proposal was confirmed

Presenter: HUERTA, Marina

Session Classification: Plenary Session

Contribution ID: **115** Type: **not specified**

N=2 SUSY field theories: A window into nonperturbative QFT ?

Tuesday, September 27, 2016 5:20 PM (30 minutes)

Considerable progress has been made in the last few years on various N=2 supersymmetric field theories. The progress includes exact results for expectation values of Wilson loop observables and various other quantities.
In my talk I will review some of these developments, and try to extract some lessons of general interest for a wider audience with interests in quantum field theory.

Presenter: TESCHNER, Joerg

Session Classification: Plenary Session

Contribution ID: **116** Type: **not specified**

Welcome

Wednesday, September 28, 2016 9:00 AM (10 minutes)

Presenter: MNICH, Joachim

Session Classification: Welcome from the DESY director

Contribution ID: **117** Type: **not specified**

Quantum moduli spaces and quantum algebras

Wednesday, September 28, 2016 9:10 AM (30 minutes)

I will review the gauge theoretical construction of quantum algebras such as q-deformed W-algebras and quantum groups from the geometry of the moduli space of quiver instantons, moduli space of monopoles and moduli space of vacua of N=2 supersymmetric gauge theories.

Presenter: PESTUN, Vasily

Session Classification: Plenary Session

Contribution ID: **118** Type: **not specified**

From Yang-Mills Theory to the Veneziano Amplitude

Wednesday, September 28, 2016 9:50 AM (30 minutes)

We consider weakly-coupled theories of massive higher-spin particles. This class of models includes, for instance, tree-level String Theory and Large-N Yang-Mills theory. The S-matrix in such theories is a meromorphic function obeying unitarity and crossing symmetry. We discuss the unphysical high-energy fixed imaginary angle scattering regime. We expect the amplitude to be universal and exponentially large in this limit. We develop methods to study this regime and show that the amplitude necessarily coincides with the Veneziano amplitude there. Our analysis shows that any such theory of higher-spin particles has stringy excitations and infinitely many asymptotically parallel subleading trajectories. More generally, we argue that, under some assumptions, any theory with at least one higher-spin particle must have strings.

Presenter: KOMARGODSKY, Zohar

Session Classification: Plenary Session

Contribution ID: **119** Type: **not specified**

Comments on families of N=2 SCFTs

Wednesday, September 28, 2016 10:30 AM (30 minutes)

I will review some exact results about the coupling constant dependence of the chiral ring in four dimensional N=2 theories.

Presenter: PAPADODIMAS, Kyriakos

Session Classification: Plenary Session

Contribution ID: **120** Type: **not specified**

Quantum Simulation of Lattice Gauge Theories

Wednesday, September 28, 2016 11:40 AM (30 minutes)

Besides lattice QCD in particle physics, strongly coupled gauge theories arise, for example, in the condensed matter physics of spin liquids, or in the quantum information theory of Kitaev's toric code, which is a Z(2) lattice gauge theory.
Numerical simulations of gauge theories on classical computers,
in particular, at high fermion density or in out-of-equilibrium situations, suffer from severe sign problems that prevent the importance sampling underlying Monte Carlo calculations. Quantum simulators are accurately controllable quantum devices that mimic other quantum systems. They do not suffer from sign problems, because their hardware is intrinsically quantum mechanical. Recently, trapped ions, following a laser-driven stroboscopic discrete time evolution through a sequence of quantum gate operations, have been used as a digital quantum
simulator for particle-anti-particle pair creation in the Schwinger model.
Analog quantum simulators, on the other hand, follow the continuous time-evolution of a tunable model Hamiltonian. Using ultra-cold atoms in optical lattices, analog quantum simulators have been designed for Abelian and non-Abelian lattice gauge theories. Their experimental realization is a challenge for the foreseeable future, which holds the promise to access the
real-time dynamics of string breaking, the out-of-equilibrium decay of a false vacuum, or the evolution of a chiral condensate after a quench, from first principles. Quantum link models which realize gauge theories including QCD not with classical fields but with discrete quantum degrees of freedom, are ideally
suited for implementation in quantum matter. For example, alkaline-earth atoms, whose nuclear spin represents an SU(N) degree of freedom, naturally embody fermionic rishon constituents of gluons.

Presenter: WIESE, Uwe-Jens

Session Classification: Plenary Session

Contribution ID: **121** Type: **not specified**

A Duality Web in 2 + 1 Dimensions and the Unity of Physics

Wednesday, September 28, 2016 12:20 PM (30 minutes)

Combining insights from different branches of physics we will present a rich set of dualities in 2+1 dimensions

Presenter: SEIBERG, Nathan

Session Classification: Plenary Session

Contribution ID: **122** Type: **not specified**

Quantum Field Theory Without Quantum Fields: Scattering Amplitudes as Binary Code

Thursday, September 29, 2016 11:30 AM (40 minutes)

Presenter: ARKANI-HAMED, Nima

Session Classification: Plenary Session

Contribution ID: **123** Type: **not specified**

Constructing Gravity Theories from Gauge Theories

Thursday, September 29, 2016 9:40 AM (40 minutes)

I will discuss how gravity scattering amplitudes of many different gravitational theories can be obtained from various gauge theories through a double-copy procedure. The basic idea goes back to the old relation between open and closed strings, but I will argue that gravity being the double copy of two gauge theories is a more general notion. I will present new striking examples of gravity theories being double copies, and identify the corresponding underlying gauge theories.

Presenter: JOHANSSON, Henrik

Session Classification: Plenary Session

Contribution ID: **124** Type: **not specified**

Worldsheet Models in Quantum Field Theory

Thursday, September 29, 2016 10:20 AM (40 minutes)

The last years have seen remarkable progress in understanding the scattering amplitudes of massless particles in arbitrary dimension. They not only exhibit a simplicity completely obscured by the Feynman Diagram approach, but also a structure strikingly reminiscent of the worldsheet models describing string theory. After reviewing the key developments, I will discuss the worldsheet models, derive the loop integrands, and finally aim to draw some general conclusion about scattering in massless theories.

Presenter: GEYER, Yvonne

Session Classification: Plenary Session

Contribution ID: **125** Type: **not specified**

Integrability in gauge and string theory

Thursday, September 29, 2016 9:00 AM (40 minutes)

In this talk I will give an overview of various developments in integrability within the AdS/CFT correspondence emphasizing novel directions and setups. I will also point out some outstanding questions.

Presenter: JANIK, Romuald

Session Classification: Plenary Session

Contribution ID: **126** Type: **not specified**

Tensor Networks and their use for Lattice Gauge Theories

Thursday, September 29, 2016 12:10 PM (40 minutes)

The term Tensor Network States (TNS) has become a common one in the context of numerical studies of quantum many-body problems. It refers to a number of families that represent different ansatzes for the efficient description of the state of a quantum many-body system. The first of these families, Matrix Product States (MPS), lies at the basis of Density Matrix Renormalization Group methods, which have become the most precise tool for the study of one dimensional quantum many-body systems. Their natural generalization to two or higher dimensions, the Projected Entanglement Pair States (PEPS) are good candidates to describe the physics of higher dimensional lattices. Another TNS ansatz, the MERA, has recently been connected to a discrete realization of the AdS/CFT correspondence.

TNS can be used to study equilibrium properties, as ground and and thermal states, but also dynamics. Quantum information gives us some tools to understand why these families are expected to be good ansatzes for the physically relevant states, and some of the limitations connected to the simulation algorithms.

Lattice Gauge Theories, in their Hamiltonian version, offer a challenging scenario for these techniques. While the dimensions and sizes of the systems amenable to TNS studies are still far from those achievable by Monte Carlo simulations, Tensor Networks can be readily used for problems which more standard techniques cannot easily tackle, such as the presence of a chemical potential, or out-of-equilibrium dynamics.

The last years have seen an increasing interest in this particular application of Tensor Network techniques. The performance of Matrix Product States (MPS) has been explored in the case of the Schwinger model, as a widely used testbench for lattice techniques. The low energy states of the model, away from any perturbative regime, have been shown to be well approximated by the MPS ansatz. The precision achieved by the method allows for accurate finite size and continuum limit extrapolations of the ground state energy, but also of the mass gaps and temperature dependent quantities, thus showing the feasibility of these techniques for gauge theory problems. The feasibility of the method has already been tested also for non-Abelian models, out-of-equilibrium scenarios, and non-vanishing chemical potential.

Presenter: BANULS, Mari Carmen

Session Classification: Plenary Session

Contribution ID: **127** Type: **not specified**

Locality and Quantum Physics: the Algebraic Approach to Quantum Field Theory

Friday, September 30, 2016 9:00 AM (30 minutes)

The locality of fundamental interactions and the nonlocal
character of quantum correlations are reconciled in the framework of algebraic quantum field theory. The theory is based on the concept of local fields which are mathematically characterized as natural tranformations between suitable functors. The framework covers quantum field theories on generic Lorentzian manifolds including also perturbative quantum gravity.

Presenter: FREDENHAGEN, Klaus

Session Classification: Plenary Session

Contribution ID: **128** Type: **not specified**

Conformal bootstrap overview

Friday, September 30, 2016 9:40 AM (30 minutes)

In this talk we will give an overview of recent results obtained from the bootstrap approach to CFTs. We will discuss both analytical and numerical results, including for supersymmetric theories. We identify several promising directions for further research

Presenter: VAN REES, Balt

Session Classification: Plenary Session

Contribution ID: **129** Type: **not specified**

Unitarity and positivity constraints for CFT at large and central charge

Friday, September 30, 2016 10:20 AM (30 minutes)

Presenter: ALDAY, Luis Fernando

Session Classification: Plenary Session

Contribution ID: **130** Type: **not specified**

RG Inequalities in Diverse Dimensions

Friday, September 30, 2016 11:30 AM (30 minutes)

Presenter: DUMITRESCU, Thomas

Session Classification: Plenary Session

Contribution ID: **131** Type: **not specified**

Restriction on the initial state for the absence of IR effect in single field inflation

Friday, September 30, 2016 12:10 PM (30 minutes)

It has been claimed that the super Hubble modes generated during inflation can make loop corrections diverge. Even if we introduce an infrared (IR) cutoff at a comoving scale as an ad hoc but a practical way for the regularization, we encounter the
secular growth, which may lead to the breakdown of perturbative expansion for a sufficiently long lasting inflation. We show that the IR pathology can be attributed to the presence of residual gauge degrees of freedom in the local observable universe.
We will show that choosing the Euclidean vacuum as the initial state ensures the invariance under the above-mentioned residual gauge transformations. We will also show that as long as we consider a gauge invariant quantity in the local universe,
we encounter neither the IR divergence nor the secular growth.

Presenter: TANAKA, Takahiro

Session Classification: Plenary Session

Contribution ID: **132** Type: **not specified**

Hertz Lecture

Thursday, September 29, 2016 5:30 PM (1 hour)

Presenter: SEIBERG, Nathan

Session Classification: Hertz Lecture