String: T-duality, Integrability and Geometry

Abstracts

Ctirad Klimcik

Title: The dynamics of non-degenerate and degenerate E-models, I,II,III

Abstract:
E-model is a particular dynamical system, the phase space of which is the symplectic current algebra of a the so called Drinfeld double D and the Hamiltonian of which is given by a quadratic form E on the current algebra. It turns out that one particular E-model can encapsulate the dynamics of several non-linear sigma-models with geometrically inequivalent targets. Said in other words, the E-models play the proeminent role in the study of the phenomenon called T-duality because they offer the duality invariant description of the common dynamics of the pairs of mutually T-dual sigma-models.

The E-model description of the dynamics permits to tackle in a technically efficient way also the questions related to the integrability of the non-linear models. In particular, the corresponding Lax pairs establishing the integrability can be exhaustively expressed in terms of the (duality invariant) currents.

The E-models turn out to be useful also for the study of the renormalizability of the sigma-models because they transform the complicated duality non-invariant equations for the Ricci flow into simple duality invariant RG flows on the space of the quadratic forms on the current algebras.

It turns out that all what was said so far apply also to the so called degenerate E-models (called also the dressing cosets) which make the pattern of T-duality, integrability and renormalizability even richer. The degenerate E-models, being underexplored so far, offer a large space for producing new results.

In my lectures, I describe in details the dynamics of the non-degenerate as well as of the degenerate E-model, and, paralelly to this principal axis of the presentation, I shall explain the concepts of T-duality, integrability, Ricci flow and Poisson-Lie groups.

Yolanda Lozano

Title: Non-Abelian T-duality and the AdS/CFT correspondence, I,II

Abstract:
We will review latest developments on the applications of non-Abelian T-duality to the study of the AdS/CFT correspondence, with special focus on: i) Its far-reaching potential, as a solution generating technique, in the construction of new AdS spaces and, ii) Recent progress towards its interpretation from the CFT side of the correspondence.

GPPU lecture:

Title: Why duality is so important in string theory

Abstract:
Some of the most important developments in String Theory in the last decades have been based on the {\it duality symmetries} that this vast and rich theory poses. In this talk we will go throw a thorough overview of these symmetries highlighting their importance in our current understanding of String Theory and its recent applications.

Yuho Sakatani

Title 1: Double/Exceptional Field Theory and Generalized Supergravity

Abstract:
Recently, Yang-Baxter (YB) deformations and the non-Abelian T-duality have been actively studied. These transformations usually produce solutions of the supergravity, but under certain conditions, they produce solutions of deformed supergravity equations of motion, known as the Generalized Supergravity Equations of motion (GSE). In this talk, we review a manifestly T-duality-covariant formulation of the supergravity, known as the double field theory (DFT), and show that the GSE can be reproduced from DFT. This shows that the DFT is a natural formulation to study YB-deformed backgrounds and non-Abelian T-dualized backgrounds. We also review a generalization of DFT, called the exceptional field theory (EFT), and discuss various deformed supergravities that can be reproduced from EFT.

Title 2: Type II DFT solutions from Poisson-Lie T-duality/plurality

Abstract:
We discuss the non-Abelian T-duality in the presence of the B-field and Ramond-Ramond fields, and under a certain condition, we provide the duality transformation rule in a closed form. We demonstrate the usefulness of the transformation rule by studying some concrete examples. We obtain a similar formula for a more general duality, known as the Poisson-Lie T-duality, or its further generalization, the Poisson-Lie T-plurality. As an application of the Poisson-Lie T-plurality, we find several new supergravity solutions with Ramond-Ramond fields.

Pierre Bieliavsky

Title: Quantum groups as symmetries of deformed systems: some (new) examples.

Abstract:
I will present a class of (locally compact) quantum groups and quantum spaces.

Jeong-Hyuck Park

Title1: Green-Schwarz superstring on doubled-yet-gauged spacetime

Abstract:
This lecture introduces the notion of doubled-yet-gauged spacetime as the underlying mathematical space for Double Field Theory, and then constructs relevant point-particle as well as string actions, including a kappa-symmetric Green-Schwarz superstring action.

Title 2: DFT as Stringy Gravity: Einstein Double Field Equations

Abstract:
This lecture introduces Double Field Theory as the unique extension of General Relativity prescribed by the stringy O(D,D) symmetry. In particular, it presents the O(D,D) completion of Einstein Field Equations, which unifies all the equations of motion of closed-string massless sector.

Yuji Satoh

Title: World-sheet approaches to non-geometric backgrounds in string theory

Abstract:
We discuss world-sheet approaches to non-geometric backgrounds in string theory, which are valid even at the string scale. First, we give a systematic construction of the world-sheet partition functions of T-folds based on the momentum lattice. We observe that the action of T-duality on the world-sheet is generally uplifted. Such a construction is also applied to obtain non-supersymmetric vacua with small cosmological constant. Second, we discuss applications of the world-sheet conformal interfaces/defects.

Since they implement the symmetries of the world-sheet theory (CFT), including T-duality, they are expected to play a fundamental role in the world-sheet approach to the non-geometric backgrounds.

Junichi Sakamoto

Title: T-folds from Yang-Baxter deformations

Abstract:

Yang-Baxter (YB) deformations of the AdS_5×S^5 superstring have been well studied from the viewpoint of classical integrability. However, most of the works are focused upon the local structure of the deformed geometries and the global structure still remains unclear. In this talk, we discuss the non-geometric nature of YB-deformed backgrounds. We first show that the homogeneous YB deformation is precisely equivalent to a beta-transformation which is a kind of O(d,d) transformations. After that, we clarify T-fold structures of YB deformed backgrounds by explicitly showing the associated O(d,d; Z) T-duality monodromy. When we consider non-unimodular YB deformations, the deformed geometries are solutions of the generalized supergravity equations (GSE). In these cases, the extra vector field in GSE plays the role of the trace of the non-geometric Q-flux. In this way, many solutions of generalized supergravity can be regarded as T-folds. This talk is mainly based on 1803.05903 and 1710.06849.

Falk Hassler

Title: Poisson-Lie Symmetry and Double Field Theory, I,II

Abstract:

Both constituents of my title are well established areas of research with a wide range of applications. Unfortunately, in the current standard formulation of DFT only the tiny subset of PL symmetry which gives rise to abelian T-duality is manifest. In my talk, I present an altered DFT version, DFT on group manifolds, which make the full PL symmetry manifest. We discuss both the NS/NS and R/R sector of the theory. Later allows us to derive the transformation rules for R/R field strengths under full PL T-duality for the first time. If time permits, I will also comment on applications in integral deformations and the extension of the framework to also capture dressing cosets.

Noriaki Ikeda

Title: Geometry of covariant double field theory from supergeometry

Abstract:

We present our analysis about background geometric structures of double field theory including fluxes in terms of supergeometry. The section condition (closure condition) is formulated as a coordinate independent cohomological condition. We formulate the DFT in a $GL(2D)$ covariant formulation. The formalism can be applied to a generalized Scherk-Schwarz compactification and a DFT on a group manifold. Moreover, a complicated geometric structure is reformulated as a simple generalized master equation. As a result of simplification, we have found a new generalized Bianchi identity.

Benoît Vicedo

Title 1: Integrable deformations and Poisson-Lie T-duality

Title 2: Integrable coupled sigma-models

Abstract:

I will begin by reviewing how classical integrable sigma models can be recast as classical Gaudin models associated with affine Kac-Moody algebras, or affine Gaudin models for short. One usually thinks of the Gaudin model as a spin chain, since it can be obtained from a certain limit of the XXX spin chain. When viewed in this way, integrable sigma models are essentially described by affine Gaudin models with a single site. It is then very natural, in this formalism, to consider affine Gaudin models with arbitrarily many sites. I will then go on to show that such multi-site classical Gaudin models can be used to

construct new relativistic classical integrable field theories that couple together an arbitrary number of integrable sigma models. This talk is based on joint work, arXiv:1811.12316 and to appear, with F. Delduc, M. Magro and S. Lacroix.

Eoin O. Colgain

Title: The gravity/CYBE correspondence

Abstract:
Building on the pioneering work of Klimcik and later Delduc, Magro, Vicedo, Matsumoto and Yoshida introduced the notion of the "gravity/CYBE correspondence", a generic relation between r-matrix solutions to the Classical Yang-Baxter Equation and deformations of (super)gravity solutions. In this talk we present this correspondence in arguably its most general setting.

Suguru Okumura

Title: A modified Penrose limit and generalized pp-wave solutions

Abstract:
We study the Penrose limit of Yang-Baxter deformed AdS5×S5 backgrouds.
By taking the usual Penrose limit, deformed backgrounds become a well-known maximally supersymmetric pp-wave solution of type IIB SUGRA. However, by rescaling a deformation parameter by the AdS radius at the same time, one can obtain non-trivial pp-wave solutions.
In particular, we derived a pp-wave solution of generalized SUGRA from a non-unimodular deformed background.

Kentaroh Yoshida

Title: Weyl anomaly cancellation in string theories on generalized supergravity backgrounds

Abstract:
Recently, there has been a fundamental and significant development in the Green-Schwarz (GS) formulation of superstring theory.In this formulation, the kappa-symmetry plays a central role to ensure the consistency of the theory. In 2016, Tseytlin and Wulff showed that the kappa-symmetry constraints of the GS superstring defined on an arbitrary background lead to a ``generalized" supergravity, which contains an additional (non-dynamical) vector field, rather than the standard supergravity. In this talk, I will briefly introduce what the generalized supergravity is, and then discuss the cancellation of Weyl anomaly in string theories on generalized supergravity backgrounds.