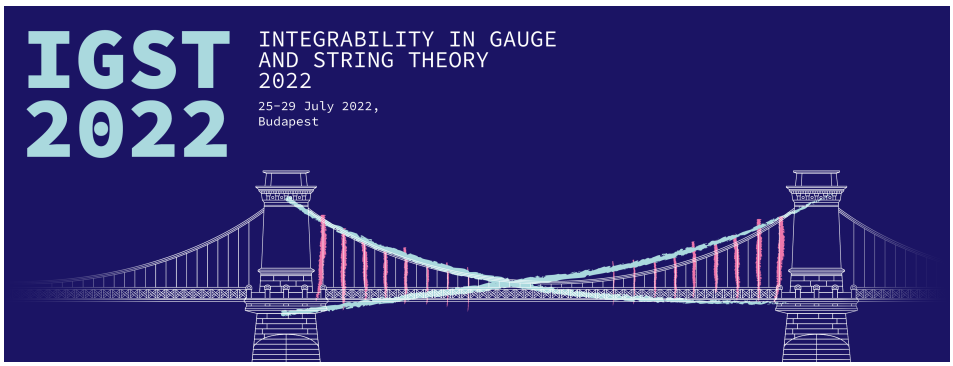
Integrability in Gauge and String Theory 2022



Report of Contributions

https://indico.wigner.hu/e/1370

Contribution ID: **58** Type: **Poster**

Bethe-like ansatz, the exact WKB method and TBA (Thermodynamic Bethe Ansatz) systems in quantum mechanics

Bethe ansatz equation is used to obtain exact solutions of many integrable models, including the famous Hisenberg XXX spin chain problem. Interestingly, similar kind of equations also appear in the different settings of quantum mechanics. Here, we show how this Bethe-like ansatz can be used to obtain energy spectrum and wave function of hydrogen atom and what are the limitations of this ansatz. For general polynomial potential we need to go into exact WKB method and the Thermodynamic Bethe ansatz. Using results of quartic polynomial potential, we investigate the energy spectrum of |x| potential which has derivative discontinuity. Our analytical results are matching well with the numerical computation.

Primary author: AHMED, Ayaz (Indian Institute of Technology Bombay)

Contribution ID: **59** Type: **Poster**

Hidden symmetries in 4D $\mathcal{N} = 2$ SCFTs

We show that a large class of N = 2 SCFTs, which can be obtained from $\mathcal{N} = 4$ SYM via orbifolding and then marginally deforming, enjoy a quantum deformation of the $SU(4)_R$ R-symmetry of the mother $\mathcal{N} = 4$ theory. The generators of $SU(4)_R$ that would naively be broken by the orbifolding procedure actually are not lost but upgraded to quantum generators in the daughter theory, where they act via a non-trivial co-product on multiparticles states. We demonstrate that the Lagrangian is invariant and that the BPS spectrum organises in representations of the quantum deformed SU(3) $\subset SU(4)_R$.

Primary author: ANDRIOLO, Enrico (Queen Mary University of London)

Contribution ID: **60** Type: **Poster**

Bootstrapping holographic defect correlators

Tremendous progress has been achieved during the last years in bootstrapping conformal correlators at strong coupling using analytical bootstrap methods and the AdS/CFT correspondence. In particular the development of Lorentzian inversion formulae revealed helpful in reconstructing four-point functions. In this work we present how this technology can be adapted to defect setups in order to compute scalar two-point functions in the presence of a conformal defect in the strong-coupling regime. We derive a dispersion relation that allows us to efficiently generate elegant closed-form expressions for a variety of setups, and in particular we apply this method to two-point functions of single-trace half-BPS operators in the presence of the supersymmetric Wilson line defect in 4 $\mathcal{N} = 4$ SYM, using minimal input from holography.

Primary author: BARRAT, Julien (Humboldt Universität zu Berlin)

Contribution ID: **61** Type: **Poster**

Simplicity of higher order defect bootstrap

In this poster I will present an extension to the work presented at IGST 2021 in my talk on Mellin amplitudes. In particular, I will highlight the next two orders of the 4-point correlators of fundamental insertions on the 1/2 Wilson line in ABJM through a coupled system of analytic bootstrap. Some features in these simplify greatly in both expected and unexpected ways. These simplifications will be presented in link to the Mellin formalism.

Primary author: BLIARD, Gabriel (Humboldt-Berlin)

Contribution ID: **62** Type: **Poster**

Cluster algebraic description of entanglement patterns for the BTZ black hole

We study the thermal state of a two-dimensional conformal field theory, which is dual to the static BTZ black hole in the high temperature limit. After partitioning the boundary of the static BTZ slice into N subsystems, we show that there is an underlying CN−1 cluster algebra encoding entanglement patterns of the thermal state. We also demonstrate that the polytope encapsulating such patterns in a geometric manner for a fixed N is the cyclohedron CN−1. Alternatively these patterns of entanglement can be represented in the space of geodesics (kinematic space) in terms of a Zamolodchikov Y system of CN−1 type. The boundary condition for such an Y system is featuring the entropy of the BTZ black hole.

Primary author: BOLDIS, Bercel (Researcher Physicist MSc student at the Budapest University of Technology and Economics)

Contribution ID: **63** Type: **Poster**

Conformal defects and holography

In my poster I will show how to compute correlators of CFT operators in the presence of a conformal line defect using the Lorentzian discontinuities of the correlators. I will consider both bulk operators and operators inserted on the line defect. In particular I will focus on the case of a conformal line defect which is relevant for holography, the supersymmetric Wilson line in $\mathcal{N} = 4$ SYM.

Primary author: BONOMI, Davide (City, University of London)

Contribution ID: **64** Type: **Poster**

Integrable deformations and dualities of string sigma-models

On this poster, I will review recent work on the understanding of deformations and generalised T-dualities which preserve the integrability of string sigma-models. As a guiding exemplar, I will focus on the so-called Homogeneous Yang-Baxter deformations, which capture as a special case the well-known TsT-transformations. At the level of the low-energy string as well as worldsheet integrability it has been understood that many of the attractive features of TsT carry over to the generalised Yang-Baxter case. Using the framework of Double Field Theory, I show how one can easily understand Yang-Baxter deformations as solution-generating techniques of type II supergravity, and I will argue how a large web of transformations with the same feature can be more generally classified. On the other hand, I will discuss how these deformations can be equivalently described on-shell in terms of a twisting of the worldsheet boundary conditions of the undeformed sigma-model. This feature makes it particularly efficient to employ integrable methods such as the classical spectral curve and its semi-classical quantisation to obtain energy corrections. This opens a route to study integrable deformations of AdS/CFT, and I will report on progress obtained for a Homogeneous Yang-Baxter deformation of the AdS5 x S5 superstring.

Primary author: DRIEZEN, Sibylle (IGFAE, Santiago de Compostela)

Contribution ID: **65** Type: **Poster**

A worldsheet dual for $\mathcal{N} = 2$ SCFTs

We consider a special family of 4-d N=2 superconformal theories, arising as orbifolds of N=4 SYM under the action of a discrete group and leading to a circular quiver theory. Following the recent Gaberdiel-Gopakumar derivation, we construct a free field worldsheet theory in the tensionless string limit which is dual to the orbifold gauge theory at the free theory point. In particular, after imposing some specific gauge constraints on the worldsheet degrees of freedom, the spectrally flowed worldsheet spectrum is in one-to-one correspondence with the single trace operators of the free quiver theory at large N, realising the first step for the AdS/CFT correspondence in N=2 framework in the full stringy regime.

Primary author: GALVAGNO, Francesco (ETH Zürich)

Contribution ID: **66** Type: **Poster**

Integrability as a new method for exact results on quasinormal modes of black holes

In the last couple of years, a new very surprising connection emerged between $\mathcal{N} = 2$ supersymmetric gauge theory and black hole physics. Initially, it was found that quasinormal modes of black holes - as observed in the gravitational wave signal of the final ringdown phase of a merging - can be related and computed from quantization conditions on the so-called gauge theory Seiberg-Witten periods (the building blocks of the $\mathcal{N} = 2$ supersymmetric gauge prepotential). A lot of exciting developments followed, among which new theoretical and computational results on both sides of the correspondence. We in particular have been able first of all to give a mathematical proof of the connection, through the further connection we previously found of such gauge theories to quantum integrable models. Indeed, using the so called ODE/IM correspondence between Ordinary Differential Equations and Integrable Models, we related the mathematically precise definition of quasinormal modes (not so-widely known) to quantization conditions (Bethe roots condition) on various (Baxter's-) integrable functions, which we are able to relate in turn to gauge periods, thus proving the connection among three apparently very different physical theories (which however share in different ways the same ODE). Moreover, thanks to such essential identification it follows simply and elegantly a new powerful exact method to compute quasinormal modes: the Thermodynamic Bethe Ansatz nonlinear integral equation, a classic celebrated tool of quantum integrability. We compare this method to other standard and new ones and sometimes find it convenient. We do this in all details for a gravitational model which is a generalization of extremally charged (Reissner-Nördstrom) black holes. We expect in the future to be able to extend it to many other spacetimes, confident of the nowadays much larger application of the aforementioned correspondence with $\mathcal{N} = 2$ supersymmetric gauge theory. Moreover, in our approach other black hole physical quantities and observables beyond quasinormal modes (like the greybody factor, directly connected to Hawking radiation) seem essentially related to quantum integrability structures. Thus in perspective this new application of exact non-perturbative techniques from quantum integrability and $\mathcal{N} = 2$ supersymmetric gauge theory promises to give some new deeper understanding of black holes, modelled in either General Relativity or String Theory and testable through new high precision gravitational waves observations, eventually hopefully helping to discriminate between standard and new physics.

Primary author: GREGORI, Daniele (University of Bologna)

Contribution ID: **67** Type: **Poster**

Bootstrability for 1D Defect CFT

I will describe the "bootstrability" program, which combines integrability techniques in 4d $\mathcal{N} = 4$ supersymmetric Yang-Mills (SYM) and the conformal bootstrap to study beyond-the-spectrum observables in a CFT.

Focussing on the 1d defect CFT living on the Maldacena-Wilson line in $\mathcal{N} = 4$ SYM, I will show how the quantum spectral curve (QSC), a powerful integrability based method solves its spectral problem.

Then, I will show how the boostrability approach allows us to access previously unreachable quantities such as correlation functions at finite coupling — we used this method to compute with very good precision, a non-supersymmetric structure constant for a wide range of the 't Hooft coupling in the defect CFT.

Primary author: JULIUS, Julius (King's College London)

Contribution ID: **68** Type: **Poster**

Structure Constants through Quantum Spectral Curve in $\mathcal{N} = 4$ Super Yang-Mills

Primary author: KLEMENCHUK, Arthur (Ecole Normale Superieure (ENS))

Contribution ID: **69** Type: **Poster**

Universal 1-loop beta functions for integrable sigma-models

I will present a simple, new method for the 1-loop renormalization of integrable sigma-models, by treating equations of motion and Bianchi identities on an equal footing. The resulting beta functions take a universal form in terms of the Lax connection, generalizing case-by-case computations in the literature. As an application, we shall argue that classical integrability is the explanation for the 1-loop scale invariance of Yang-Baxter and lambda-deformed string sigma-models.

Primary author: LEVINE, Nat (École Normale Supérieure)

Contribution ID: **70** Type: **Poster**

A Symmetric Two Higgs Doublet Model

In the light of ongoing experimental search efforts for the dark matter and the post-Higgs Beyond the Standard Model (BSM) null results at the Large Hadron Collider (LHC), the Electroweak sector demands to be investigated for possible new scalar states discoverable at the LHC fulfilling the role of the dark matter. In this work we present a symmetric two Higgs doublet model with a discrete interchange symmetry among the two Higgs doublets ($\Phi 1 \leftrightarrow \Phi 2$). Apart from the Standard Model (SM)-like scalar state (h) with mh = 125 GeV, the model has several distinguishing features including the pseudoscalar (A), the charged scalars (H±) and the neutral scalar H, not having any direct coupling to the fermions. The neutral scalar H is assumed to have mass lighter than the 125 GeV SM-like Higgs state h. Due to the presence of a residual Z2 symmetry after the spontaneous symmetry breaking (SSB), the neutral scalar H can emerge as a viable dark matter candidate. We discuss the constraints on such scalar dark matter from the current direct and indirect detection experiments. As a by-product of this construction, the SM-like scalar h ends up having an extra invisible decay mode of $h \longrightarrow HH$ in this model which can also influence the dark matter parameter space. We discuss these model features in detail along with a guideline of relevant phenomenological searches at the LHC for this scenario.

Primary author: CHOEDON, Lobsang (Tribhuvan University-Prithvi Narayan Multiple Campus)

Contribution ID: **71** Type: **Poster**

Yang-Baxter deforming spacetime symmetries of field theories

The most famous example of AdS/CFT correspondence is given by the duality of the AdS5xS5 string and the $\mathcal{N} = 4$ SYM in the planar limit. Recently, several deformations of those integrable theories have been studied. A well known class of integrable deformations of the AdS string is given by the so-called Yang Baxter deformations. These correspond to a twist of the underlying symmetry algebra, the $\mathfrak{psu}(2,2|4)$. On the field theory side this consist of internal and spacetime symmetries. Twisting the latter lead to non-commutative field theories. I will present a procedure to obtain a gauge invariant consistent deformed action obtained by a twist consisting of a Lorentz boost and a commuting rotation.

Primary author: MEIER, Tim (Humboldt-Universität zu Berlin)

Contribution ID: **72** Type: **Poster**

Lens partition functions and integrability properties

The study of lens partitions functions for the three-dimensional $\mathcal{N} = 2$ supersymmetric gauge theories on S^3_b/Z_r generates dualities and mathematical identities. We consider equalities as hyperbolic hypergeometric solutions to the star-triangle and the star-star relation via the gauge/YBE correspondence. The correspondence allows the construction of integrable lattice spin models of statistical mechanics by the use of integral identities.

Primary author: MULLAHASANOGLU, Mustafa (Boğaziçi University)

Contribution ID: **73** Type: **Poster**

Bethe ansatz solution for a new integrable open quantum system

In nature, the interaction of a system with the environment cannot be avoided. If the response of the environment is Markovian, the density matrix will evolve via the Lindblad Master equation: dependent on the Hamiltonian of the system and a jump operator describing the coupling to the environment. In PRL 126.24 (2021): 240403, we gave a partial classification of Yang Baxter Integrable interacting systems, including several new models with interesting features. In this poster, I will focus on one of the models (model B3): I will give the analytical expression of the Non Equilibrium steady states and also its physical properties. I will also show how to solve this model via the nested Algebraic Bethe Ansatz method.

Primary author: PALETTA, Chiara (Trinity College Dublin)

Contribution ID: **74** Type: **Poster**

Two-loop supergravity on AdS5 x S5 from CFT

We present a bootstrap approach to the construction of the two-loop amplitude of four graviton supermultiplets in AdS5 x S5. Starting from an ansatz for a preamplitude, the full amplitude is generated by the action of a specific Casimir operator. From the two-loop result, we extract the two-loop anomalous dimension of twist-four double-trace operators of generic spin, which includes dependence on (alternating) harmonic sums up to weight three.

Primary author: PAUL, Hynek (IPhT Saclay)

Contribution ID: **75** Type: **Poster**

Multipoint correlators on the supersymmetric Wilson line defect CFT

One dimensional CFTs are an exceptional laboratory in which we can test novel techniques in order to solve higher dimensional CFTs. They are also relevant from an holographic point of view, as in the case of the Wilson line defect in 4d $\mathcal{N} = 4$ Super Yang-Mills, which has an AdS_2 holographic dual. In this context, we focus on an under-explored subject: higher-point correlation functions. At weak coupling we developed a recursion formula that encodes n-point functions of all single-trace scalar operators. Interestingly, a class of these correlators is annihilated by a special set of differential operators, constraint that we conjectured to hold non-perturbatively and to be a multipoint extension of the superconformal Ward identities satisfied by the four-point functions. This study is a first step in the direction of a multipoint conformal bootstrap program, which could be a powerful tool for solving conformal field theory in the near future.

Primary author: PEVERI, Giulia (Humboldt Universität zu Berlin)

Contribution ID: **76** Type: **Poster**

Form factors for sl(N) spin chains via Separation of Variables

In integrable quasi-periodic spin chains with sl(N) symmetry, Functional Separation of Variables allows to compute scalar products between any so-called factorisable state, which includes all eigenvectors of the tower of conserved charges, in a compact determinant form. In this poster, we introduce Principal Operators, which are a special family of operators that generate the full Yangian algebra Y_n and give access to all observables. Using the new technique of Character Projection, we show that off-diagonal form factors of the Principal Operators on factorisable states can also be expressed as determinants. Furthermore, we show how to access form factors of anti-symmetrised multiple insertions of principal operators via the same techniques. Finally, we explicitly obtain matrix elements of the same principal operators on the so-called SoV basis. These can be used to obtain form factors on factorisable states of any number of insertions of principal operators, opening the road to the computation of correlators of local operators.

Primary author: PRIMI, Nicolò (King's college London)

Contribution ID: **77** Type: **Poster**

Spinning strings: λ-deformation and non-Abelian T-dual limit

The simplest example of the λ-deformation connects the SU(2) Wess-Zumino-Witten model with the non-Abelian T-dual (NATD) of the SU(2) principal chiral model. The poster presents spinning strings with one spin propagating through the λ-deformation of the target space of the interpolation. The situation apart from the NATD limit parallels the undeformed case. Regular spinning strings are either folded or circular, and that nearly degenerate spinning strings are either nearly point-like, fast, or slow. The effects of the λ-deformation are both the overall increment of the energy of spinning strings and the enlargement of the gap between the energies of folded and circular strings. In the NATD limit, circular strings disappear and that fast strings realize the dispersion relation of Gubser-Klebanov-Polyakov strings.

Primary author: RUIZ GIL, Roberto (Universidad Complutense de Madrid)

Contribution ID: **78** Type: **Poster**

Integrability of Type 0 and other orbifolds of AdS_5 x S^5

The integrability program has led to a wealth of techniques to describe states in the AdS/CFT duality that are not protected by supersymmetry. The extension to fundamentally non-supersymmetric theories should therefore be within the scope of the program. We analyse some of the simplest cases of non-supersymmetric deformations, namely orbifolds and especially type 0 string theory on AdS_5xS^5 as a prototypical example. Understanding the fate of the tachyon(s) will be a crucial step in this endeavour.

Primary author: SKRZYPEK, Torben (Imperial College London)

Contribution ID: **79** Type: **Poster**

Non relativistic string compactifications

Non relativistic string theory like relativistic string theory must be defined in 10 dimensions to be consistent. In this work we compactify non relativistic string theory on a torus to get a 4D particle physics theory coupled to Newtonian gravity, we also study the symmetries of the model and the resulting algebra.

Primary author: TADROS, Poula (The university of Turku)

Contribution ID: **80** Type: **Poster**

Constraining correlators from localization

While supersymmetric localization is a powerful tool for computing partition functions, it is not applicable for the direct computation of correlation functions.
However infinite sets of constraints on integrated correlators can be extracted. I will present how an improved understanding of supersymmetries on squashed 4-spheres gives one such infinite set of constraints in $\mathcal{N} = 4$. Constraints on partially integrated correlation functions have only recently been found. I will show how we achieved this by introducing position dependent masses in $4d$ $\mathcal{N} = 2$ theories with matter.

Primary author: THULL, Charles (Uppsala University)

Contribution ID: **81** Type: **Poster**

Chaos in periodically driven CFTs

Out-Of-Time-Ordered-Correlation functions (OTOCs) in thermal equilibrium has been used as a diagnostic of chaos in QFTs for times much smaller than the "scrambling time". In this poster, we will show that the OTOCs continue to be a good diagnostic of chaos even when the system is out of equilibrium. As an explicit example, we study OTOC's in a class of periodically driven CFTs. The drive profile breaks time and spatial translational symmetry, Due to the lack of translational invariance, the OTOCs show some novel features such as an spatially dependent "butterfly velocity". We compare and contrast the behaviour of the OTOCs with the case of the "undriven thermal CFT". We show that even in this non-equilibrium example, the OTOCs continue to demarcate chaotic and integrable CFTs.

Primary author: ROY, Baishali (RKMVERI, Belur)

Contribution ID: **82** Type: **Poster**

Virasoro algebras, kinematic space and the spectrum of modular Hamiltonians in CFT2

In this poster we will present the construction of an infinite class of eigenmodes of modular hamiltonian with integer eigenvalues. These eigenmodes, along with the Modular hamiltonian, satisfy the Virasoro algebra. We'll show that, the global part of the algebra is isomorphic to the algebra of modular hamiltonians of the spatial region and it's subregions. We'll also discuss the the action of these modes on OPE blocks. Then we'll briefly discuss the dual bulk construction of these modes.

Primary author: POREY, Somnath (RKMVERI)