10th Bologna Workshop on Conformal Field Theory and Integrable Models

Report of Contributions

https://agenda.infn.it/e/33911

Contribution ID: **73** Type: **Talk (20 min)**

Completing the Bootstrap Program for TTbar-deformed Massive Integrable Quantum Field Theories

Tuesday, 5 September 2023 12:20 (20 minutes)

I will summarise some of the results obtained in two recent papers (with O. Castro-Alvaredo and S. Negro) where we developed a form factor program for TTbar-perturbed integrable quantum field theories. In particular, I will show how useful information about the physics behind this particular kind of deformation can be extracted from the form factor expansion of correlation functions. This allows us to establish connections with previous results obtained through other standard integrability techniques such as thermodynamic Bethe ansatz and the theory of generalised hydrodynamics.

Primary author: SAILIS, Fabio

Presenter: SAILIS, Fabio

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **74** Type: **Invited talk**

Did you know he has a Lamborghini? Francesco's Work, Life and (some) Secrets plus New Results on Minimal Form Factors

Tuesday, 5 September 2023 14:50 (40 minutes)

In this talk I will share a few memories of nearly 25 years knowing Francesco, look at his (many!) contributions to the study of integrable quantum field theory, discuss some of our common work, and tell you a few things that you might not know about him. In the second part (time permitting) I will speak about some new work with Stefano Negro which follows from the talk of my student Fabio Sailis (earlier in the day). It is concerned with the structure of the minimal form factors of integrable quantum field theories.

Primary author: CASTRO ALVAREDO, Olalla (City University London)

Presenter: CASTRO ALVAREDO, Olalla (City University London)

Session Classification: A nice and passionate journey in low-dimensional systems

Contribution ID: **76** Type: **Invited talk**

The Frustration of Being Odd

Tuesday, 5 September 2023 09:50 (30 minutes)

We consider the effects of so-called Frustrated Boundary Conditions (FBC) on quantum spin chains, namely periodic BC with an odd number of sites. In absence of external fields, FBC allow for the direct determination of correlation functions that signal a spontaneous symmetry breaking, such as the spontaneous magnetization. When paired with anti-ferromagnetic interactions, FBC introduce geometrical frustration into the system and the ground state develops properties which differ from those present with other boundary conditions, thus brining striking, yet puzzling, evidence that certain boundary conditions can affect the bulk properties of a 1D system. We argue that FBC introduce long-range order in the system, similar to that enjoyed by SPT phases, and add a sizable amount of complexity to the ground state. Our results prove that even the weakest form of geometrical frustration can deeply affect a system's properties and pave a way for a bottom-up approach to better understand the effects of frustration and their exploitations also for technological purposes.

- J. Phys. Commun. 3, 081001 (2019);
- Nature's Comm. Phys. 3, 220 (2020);
- New J. Phys. 22 083024 (2020);
- J. Phys. A 54 025201 (2020);
- Sci Rep 11, 6508 (2021);
- Phys. Rev. B 103, 014429 (2021);
- Phys. Rev. B 105, 064408 (2022);
- Phys. Rev. B 105, 184424 (2022);
- SciPost Phys. 12, 075 (2022);
- Phys. Rev. B 106, 125145 (2022);
- arXiv:2209.10541; & work in progress

Primary author: FRANCHINI, Fabio

Presenter: FRANCHINI, Fabio

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **77** Type: **Talk (30 min)**

Exact solvability of loop models

Monday, 4 September 2023 10:20 (30 minutes)

In two-dimensional critical loop models, including the O(n) and Potts models, the spectrum is exactly known, as are a few structure constants or ratios thereof. In this talk, I will propose an exact formula for arbitrary four-point structure constants. The formula is a function of conformal dimensions, built from Barnes' double Gamma function, times a polynomial function of loop weights. Using numerical bootstrap methods, it is possible to determine this polynomial in examples, and to conjecture a bound on its degree. I will also conjecture that the polynomial can be determined in the corresponding lattice model, with a finite lattice size.

Primary author: RIBAULT, Sylvain (IPhT, CEA Saclay)

Presenter: RIBAULT, Sylvain (IPhT, CEA Saclay)

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **80** Type: **Talk (30 min)**

On the origin of the correspondence between classical and quantum integrable theories

Wednesday, 6 September 2023 09:50 (30 minutes)

If we start from certain functional relations as definition of a quantum integrable theory, then we can derive from them a linear integral equation. It can be extended, by introducing dynamical variables, to become an equation with the form of Marchenko's. Then, we derive from the latter a classical (differential) Lax pair. We exemplify our method by focusing on the massive version of the ODE/IM (Ordinary Differential Equations/Integrable Models) correspondence from Quantum sine-Gordon (sG) with many moduli/masses to the classical sinh-Gordon (shG) equation, so describing, in a particular case, some super-symmetric gauge theories and the AdS_3 strong coupling scattering amplitudes/Wilson loops. Yet, we present it in a way which reveals its generality of application. In fact, we give some hints on how it works for spin chains.

Primary authors: FIORAVANTI, Davide (Istituto Nazionale di Fisica Nucleare); ROSSI, Marco (Istituto Nazionale di Fisica Nucleare)

Presenter: ROSSI, Marco (Istituto Nazionale di Fisica Nucleare)

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **81** Type: **Talk (30 min)**

Q-operator construction for rational spin chains

Monday, 4 September 2023 15:20 (30 minutes)

I discuss the oscillator construction for Q-operators of rational spin chains in the closed and open setting. Some focus will be given on the closed case of type BCD and the orthosymplectic case osp(N|2m).

Primary authors: FRASSEK, Rouven (Istituto Nazionale di Fisica Nucleare); TSYMBALIUK, Sasha (Perdue)

Presenter: FRASSEK, Rouven (Istituto Nazionale di Fisica Nucleare)

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **83** Type: **Talk (20 min)**

Elliptic quantum toroidal algebra $U_{q,t,p}(\mathfrak{gl}_{1,tor})$ and Affine quiver gauge theories

Wednesday, 6 September 2023 12:20 (20 minutes)

We introduce a new elliptic quantum toroidal algebra $U_{q,t,p}(\mathfrak{gl}_{1,tor})$ and show some interesting representations including the level (0,0) representation given by the elliptic Ruijsenaars difference operators. We also construct intertwining operators of the $U_{q,t,p}(\mathfrak{gl}_{1,tor})$ -modules w.r.t. the Drinfeld comultiplication and give a realization of the affine quiver W-algebra $W_{q,t}(\Gamma(A_0))$ proposed by Kimura–Pestun. This realization turns out to be useful to derive the Nekrasov instanton partition functions, i.e. the χ_y - and elliptic- genus of the moduli spaces, of the 5d and 6d lifts of the 4d $calN = 2^*$ theories and provide a new Alday–Gaiotto–Tachikawa correspondence.

Primary author: KONNO, Hitoshi (Tokyo University of Marine Science and Technology)

Presenter: KONNO, Hitoshi (Tokyo University of Marine Science and Technology)

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **84** Type: **10 min Talk + Poster**

Holographic Conformal Interfaces and Their Bulk Dual

Monday, 4 September 2023 16:50 (10 minutes)

In this talk, we will study two dimensional conformal interfaces through the holographic duality. Many works in the literature identify some of their bulk duals as two AdS_3 glued together through a thin brane that meets the boundary of the (AdS) bulk at the interface.
After introducing the setup, we focus our attention mainly on two-point correlation functions of heavy operators, which can be studied in the geodesic approximation. Their structure is quite rich, due to the presence of the brane. We find analytical results using elegant and elementary geometric properties of AdS_3. These results can be used to find the relation between the spectrum of (CFT) bulk and boundary operators, which gives us cues to understand the properties of the holographic interfaces dual to these braneworld models.

Primary author: PELLICONI, Pietro (Université de Genève)

Co-authors: Prof. SONNER, Julian (Université de Genève); Dr MEINERI, Marco (Università di Torino); Prof. ANOUS, Tarek (Queen Mary University of London)

Presenter: PELLICONI, Pietro (Université de Genève)

Session Classification: Gong Session for Posters

Contribution ID: **85** Type: **Talk (20 min)**

Nonequilibrium Full Counting Statistics and Symmetry-Resolved Entanglement in integrable models

Wednesday, 6 September 2023 12:00 (20 minutes)

Due to its probabilistic nature, a measurement process in quantum mechanics produces a distribution of possible outcomes. This distribution, or its Fourier transform known as full counting statistics (FCS), contains much more information than say the mean value of the measured observable and accessing it is sometimes the only way to obtain relevant information about the system. In fact, the FCS is the limit of an even more general family of observables, the charge moments that characterise how quantum entanglement is split in different symmetry sectors in the presence of a global symmetry. I this talk I consider the evolution of the FCS and of the charged moments of a U(1) charge truncated to a finite region after a global quantum quench. Using the recently developed space-time duality approach I will show it is possible to obtain explicit TBA formulae for the quench dynamics of the charged moments. I will discuss several checks of this result and present a number of applications including to the quantum Mpemba effect in the XXZ model, which describes anomalously fast relaxation from certain initial states.

Primary author: RYLANDS, Colin (SISSA)

Presenter: RYLANDS, Colin (SISSA)

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **86** Type: **Talk (30 min)**

Negative tripartite information after quantum quenches in integrable systems

Monday, 4 September 2023 15:50 (30 minutes)

We build the quasiparticle picture for the tripartite mutual information (TMI) after quantum quenches in spin chains that can be mapped onto free-fermion theories. A nonzero TMI (equivalently, topological entropy) signals quantum correlations between three regions of a quantum many-body system. The TMI is sensitive to entangled multiplets of more than two quasiparticles, i.e., beyond the entangled-pair paradigm of the standard quasiparticle picture. Surprisingly, for some nontrivially entangled multiplets the TMI is negative at intermediate times. This means that the mutual information is monogamous, similar to holographic theories. Oppositely, for multiplets that are "classically" entangled, the TMI is positive. Crucially, a negative TMI reflects that the entanglement content of the multiplets is not directly related to the Generalized Gibbs Ensemble (GGE) that describes the post-quench steady state. Thus, the TMI is the ideal lens to observe the weakening of the relationship between entanglement and thermodynamics. We benchmark our results in the XX chain and in the transverse field Ising chain. In the hydrodynamic limit of long times and large intervals, with their ratio fixed, exact lattice results are in agreement with the quasiparticle picture.

Primary author: Dr CACEFFO, Fabio

Co-author: ALBA, Vincenzo (Istituto Nazionale di Fisica Nucleare)

Presenter: ALBA, Vincenzo (Istituto Nazionale di Fisica Nucleare)

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **87** Type: **Talk (20 min)**

Hidden strong symmetries in a range 3 deformation of the Hubbard model

Monday, 4 September 2023 11:40 (20 minutes)

We consider a spin chain corresponding to an open quantum system described by the Lindblad equation, where the external driving acts in the bulk. This model corresponds to a new integrable range 3 elliptic deformation of Hubbard. We show the appearance of multiple NESS: the system retains memory of the initial state, even though the obvious symmetries of the Hamiltonian are broken. We motivate this by the existence of hidden strong symmetries in the form of quasi-local operators. Furthermore, we comment on the existence of the Liouville gap, related to the relaxation time.
Based on the works 2301.01612 and 2305.01922 with M. de Leeuw, B. Pozsgay and E. Vernier.

Primary authors: Dr DE LEEUW, Marius (Trinity College Dublin); PALETTA, Chiara (Trinity College Dublin); Dr POZSGAY, Balazs (Eotvos Lorand University Budapest); Dr VERNIER, Eric (Sorbonne University Paris)

Presenter: PALETTA, Chiara (Trinity College Dublin)

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **88** Type: **Talk (30 min)**

Structure Constants of Short Operators in N=4 Super-Yang Mills

Wednesday, 6 September 2023 15:50 (30 minutes)

$\mathcal{N} = 4$ Super Yang-Mills Theory in 4 dimensions is a Super-conformal Gauge Theory known to be integrable in the planar limit. In the past decade its full finite size spectrum was solved by the Quantum Spectral Curve (QSC) method. Structure Constants for asymptotically large operators were computed at finite t'Hooft coupling by the integrability based Hexagonalization approach. However the finite size corrections to the latter present a complicated structure and divergences that are hard to regularize. In this talk I will present a conjecture for the resummation of all this wrapping corrections for a particular class of Three-Point Functions composed by one non-protected and two protected operators. Our result unifies the Hexagon and QSC methods for the first time and I will show how it reproduce 5-loop weak coupling data as well as String Theory data at strong coupling. Based on Phys.Rev.Lett. 130 (2023) 13, 131603

Primary authors: Dr GEOGOURDIS, Alessandro (NORDITA); KLEMENCHUK SUEIRO, Arthur (LPENS, IPhT); Dr BASSO, Benjamin (LPENS)

Presenter: KLEMENCHUK SUEIRO, Arthur (LPENS, IPhT)

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **89** Type: **Talk (30 min)**

Exactly solvable subspaces of spin-1 chains with boundaries and quasiparticle interactions

Thursday, 7 September 2023 11:10 (30 minutes)

We propose a new family of non-integrable spin-1 chains with exactly solvable subspace. Based on the idea of the tower of quasiparticle excitations, a series of non-integrable Hamiltonians with exactly solvable subspace and the associated exactly solvable energy eigenstates is constructed. The obtained exactly solvable energy eigenstates are the candidates of quantum many-body scar states, since they are equipped with entanglement entropies which are expected to behave as the sub-volume law. Generalizations to the non-trivial boundary and quasiparticle interacting cases has been achieved by removing the frustration-free condition and the local orthogonality condition from the original construction of the tower of quasiparticle states. We found that the equally spaced energy spectrum structure is not violated by the diagonal boundaries. We also found that there exists the non-integrable spin-1 chain with the energy spectrum in which the spectrum of the spin-1/2 XXX model is embedded.

Primary author: MATSUI, Chihiro (The University of Tokyo)

Presenter: MATSUI, Chihiro (The University of Tokyo)

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **90** Type: **Talk (20 min)**

Homotopy Manin triples and higher current algebras

Monday, 4 September 2023 12:00 (20 minutes)

The notion of a Manin triple of Lie algebras arises in many contexts in quantum integrable systems and beyond. After recalling the general definition, I will describe one important class of examples involving current algebras, i.e. certain Lie algebras associated to the punctured formal disc in complex dimension one. Studying these examples naturally leads one to recover the ideas of vertex algebras and rational
conformal blocks, as I will try to describe.

Now, one would like to generalize all this to higher complex dimensions. (I will sketch one source of motivation, coming from quantum Gaudin models and integrable quantum field theory.) A possible approach to doing so starts with higher current algebras in the sense Faonte, Hennion and Kapranov. I will review the definition, which involves passing from Lie algebras to their differential graded (dg) analogs. In the dg setting, it is natural to relax the definition of a Manin triple, by requiring some statements to hold only up to homotopy. I will describe some recently constructed examples of such homotopy Manin triples, and sketch some applications, in particular to higher rational conformal blocks.

This talk is based on arXiv:2208.06009, to appear in J. Geom. Phys, and work in progress, joint with Luigi Alfonsi.

Primary author: YOUNG, Charles (University of Hertfordshire, UK)

Presenter: YOUNG, Charles (University of Hertfordshire, UK)

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **91** Type: **Talk (20 min)**

Arctic curves of the four-vertex model

Thursday, 7 September 2023 11:40 (20 minutes)

We consider the four-vertex model with a particular choice of fixed boundary conditions, closely related to scalar products of off-shell Bethe states. In the scaling limit, the model exhibits the limit shape phenomenon, with the emergence of an arctic curve separating a central disordered region from six frozen 'corners' of ferroelectric or anti-ferroelectric type. We determine the analytic expression of the interface by means of the EFP method. This is based on the exact evaluation of suitable correlation functions, discriminating spatial transition from order to disorder, in terms of the partition function of some discrete log-gas associated to Hahn polynomials. As a by-product, we also deduce that the arctic curve's fluctuations are governed by the Tracy-Widom distribution.

Primary authors: PRONKO, Andrei (PDMI St. Petersburg); COLOMO, Filippo (INFN)

Co-authors: MARONCELLI, Andrea (Istituto Nazionale di Fisica Nucleare); BURENEV, Ivan (ENS Paris)

Presenter: MARONCELLI, Andrea (Istituto Nazionale di Fisica Nucleare)

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **92** Type: **Talk (20 min)**

N=8 supergravity as a theoretical laboratory for gravitational scattering

Tuesday, 5 September 2023 11:40 (20 minutes)

Scattering amplitudes in gravitational theories provide useful tools for the calculation of observables associated to encounters of compact objects, such as black holes and neutron stars. In this talk, I will discuss recent progress in exploring the classical limit of scattering amplitudes and their connection to gravitational observables in $\mathcal{N} = 8$ supergravity, which serves as a theoretical laboratory for developing such tools in a technically simpler arena compared to Einstein gravity. An interesting point concerns the integrability of bound orbits of binary half-BPS black holes in maximal supergravity, which as pointed out by Caron-Huot and Zahraee, prohibits orbital precession in the probe limit. I will illustrate how the eikonal phase obtained from the two-loop $2 \to 2$ amplitude determines the deflection angle for hyperbolic encounters and, via analytic continuation, the precession angle for bound orbits, yielding nontrivial precession beyond the strict probe liimit.

Primary author: HEISSENBERG, Carlo (Uppsala University and Nordita)

Presenter: HEISSENBERG, Carlo (Uppsala University and Nordita)

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **93** Type: **Talk (20 min)**

Viscous GHD at low temperatures

Wednesday, 6 September 2023 17:00 (20 minutes)

An infinite number of evolution equations dictate the dynamics of quantum integrable models according to generalized hydrodynamics (GHD). At the Euler scale in the T=0 limit, with a single Fermi sea, GHD is known to become equivalent to conventional Euler hydrodynamics. The T=0 GHD, also known as zero entropy GHD, describes integrable models with the splitting of Fermi seas, which has no conventional analog. Our goal is to consider a small temperature diffusive correction to these equations in an attempt to better understand the relationship between GHD and CHD. By carrying out a low-temperature expansion for the diffusive kernel the diffusive GHD equations are likewise found to truncate. This yields an identification between viscous GHD and conventional viscous hydrodynamics, written in a universal fashion by use of Luttinger liquid parameters.

Primary authors: URILYON, Andrew; SCOPA, Stefano; DE NARDIS, Jacopo

Presenter: URILYON, Andrew

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **94** Type: **Talk (30 min)**

Critical points of coupled Potts models and correlated percolation

Monday, 4 September 2023 11:10 (30 minutes)

The idea that ferromagnetic transitions correspond to the percolation of clusters of like spins has been present since the early days of the theory of critical phenomena. It turned out, however, that its implementation requires trading the obvious spin clusters for a more sophisticated version known as Fortuin-Kasteleyn clusters. It has been conjectured for long time that in the two-dimensional q-state Potts model the critical properties of Fortuin-Kasteleyn and spin clusters are related by analytical continuation. We access for the first time in an exact way the relevant renormalization group fixed points and show that the conjecture does not in general hold.

Primary author: DELFINO, Gesualdo (Istituto Nazionale di Fisica Nucleare)

Presenter: DELFINO, Gesualdo (Istituto Nazionale di Fisica Nucleare)

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **95** Type: **10 min Talk + Poster**

Relaxation and Energy Transfer in the (Double) Quantum Sine-Gordon Model

Monday, 4 September 2023 17:00 (10 minutes)

The sine-Gordon model is a well-known integrable field theory which provides an effective description for systems such as Josephson-coupled one-dimensional bosonic quasi-condensates. The model can be interpreted as a quantum pendulum coupled to a phononic bath of interacting oscillators. A key question is the energy transfer dynamics between these modes when the system is out of equilibrium and how the breakdown of integrability affects this process. In this study, we investigate these questions by simulating the full quantum dynamics following quantum quenches, specifically focusing on energy transfer between the modes and correlations of the phase field.

To carry out our investigation, we employ a novel truncated conformal space approach (TCSA) complemented by a mini-superspace, enabling full quantum simulations that extend closer to the experimentally accessible parameter range than previous studies. By comparing our results with semi-classical truncated Wigner approximation (TWA) simulations, we gain insights into the validity range of the two methods and identify their differences.

Through this research, we aim to enhance our understanding of relaxation and energy transfer phenomena in the (double) quantum sine-Gordon model, shedding light on the dynamics under non-equilibrium conditions and the implications of integrability breakdown.

Primary author: SZÁSZ-SCHAGRIN, Dávid (Budapest University of Technology and Economics)

Co-authors: TAKACS, Gabor (Department of Theoretical Physics, Budapest Unitersity of Technology and Economics); Dr LOVAS, Izabella (Kavli Institute for Theoretical Physics, University of California)

Presenter: SZÁSZ-SCHAGRIN, Dávid (Budapest University of Technology and Economics)

Session Classification: Gong Session for Posters

Contribution ID: **96** Type: **10 min Talk + Poster**

Charge Imbalance resolved Rényi negativity of free compact boson

Monday, 4 September 2023 17:40 (10 minutes)

When a theory possesses an additive global internal symmetry, its spatial entanglement spectrum for the states with fixed a global charge may be resolved into the local charge sectors corresponding to the subsystem. This has been termed symmetry-resolved entanglement. Free compact bosons possess a global U(1) symmetry due to invariance under translations in the target space. I will discuss the symmetry resolution of entanglement between two disjoint intervals for free compact boson in its ground state. Since we have a mixed state in two disjoint interval, we must study the negativity measures. I will discuss the symmetry resolution of Renyi negativity in this proposed talk. While Renyi negativity in itself is not an optimal entanglement measure, but contains all the information needed to compute negativity measures.
Reference: https://link.springer.com/article/10.1007/JHEP02(2023)118

Primary authors: GAUR, Himanshu (Indian Institute of Technology Bombay); Prof. YAJNIK, Urjit A. (Indian Institute of Technology Bombay)

Presenter: GAUR, Himanshu (Indian Institute of Technology Bombay)

Session Classification: Gong Session for Posters

Contribution ID: **97** Type: **10 min Talk + Poster**

Entanglement along a massless flow: the tricritical Ising model

Monday, 4 September 2023 17:10 (10 minutes)

In recent decades, the study of entanglement has attracted interest in several areas. In particular, in conformal field theories, the entanglement entropy of an interval is known to grow logarithmically with the size of the system, proportional to the central charge of the CFT.
On the other hand, CFTs describe the fixed points of the renormalization group flow. It is therefore interesting to study how entanglement varies as we move along a renormalization group, interpolating between two different CFTs.
In this work we study the entanglement entropy of an interval in the integrable massless renormalization flow connecting the UV tricritical and the IR critical Ising CFTs. We compute the form factors of twist fields along the flow and we find the first correction to the IR entanglement entropy. Near the IR, the massless flow is described by a $T\bar{T}$ deformation of the Ising CFT and we recover the predicted fuctional form for a $T\bar{T}$ deformed CFT.

Primary author: ROTTOLI, Federico (SISSA)

Presenter: ROTTOLI, Federico (SISSA)

Session Classification: Gong Session for Posters

Contribution ID: **98** Type: **Talk (30 min)**

Regge spectroscopy of higher twist states in $\mathcal{N} = 4$ supersymmetric Yang-Mills theory

Thursday, 7 September 2023 14:30 (30 minutes)

We study a family of higher-twist Regge trajectories in $\mathcal{N} = 4$ supersymmetric Yang-Mills theory using the Quantum Spectral Curve. We explore the many-sheeted Riemann surface and show the interplay between the higher-twist trajectories and the several degenerate non-local operators, called (near-)horizontal trajectories, that have a strong connection to light ray operators, objects omnipresent in 4-dimensional Minkowskian CFTs.
We resolve the encountered degeneracy analytically by computing the first non-trivial order of the Regge intercept at weak coupling, which exhibits new behaviour: it depends linearly on the coupling. This is consistent with our numerics, which interpolate all the way to strong coupling.

Primary author: SZECSENYI, Istvan Mate (Nordita)

Co-authors: Dr PRETI, Michelangelo (KCL); Dr KLABBERS, Rob (Humboldt University Berlin)

Presenter: SZECSENYI, Istvan Mate (Nordita)

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **99** Type: **Talk (30 min)**

Q-operators for Open Quantum Spin Chains

Tuesday, 5 September 2023 10:20 (30 minutes)

I will describe recent progress in the understanding and construction of Q-operators for open quantum spin chains. The construction exploits the the universal K-matrix picture of Appel and Vlaar. The resulting open Q-operator and the functional relations it obeys follow by pure representation theory; this opens the route to broad generalisation.

Primary author: WESTON, Robert (Heriot-Watt University)

Presenter: WESTON, Robert (Heriot-Watt University)

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **100** Type: **Talk (20 min)**

One-particle density matrix of the out-of-equilibrium Tonks-Girardeau gas: exact results from Quantum Generalized Hydrodynamics

Wednesday, 6 September 2023 16:40 (20 minutes)

Understanding the non-equilibrium dynamics of many-body quantum systems is a notoriously hard task due to the exponential increase of the Hilbert space dimension with the number of the system's components. This prevented, for a long time, a direct comparison between theory and the available experimental measures with ultracold atoms and ions. In recent years, the advent of Generalized Hydrodynamics enabled significant steps forward, allowing quantitative predictions for some transport properties (e.g. density and current profiles during the dynamics) of experimentally-feasible quantum setups. But despite its great predictive power, Generalized Hydrodynamics (like any hydrodynamic theory) does not capture important quantum effects, such as equal-time correlations among different points and zero-temperature entanglement. A way to account for these missing quantum effects is established by the so-called Quantum Generalized Hydrodynamics, where an effective field theory description of the leading quantum fluctuations is incorporated over the evolving background set by Generalized Hydrodynamics. In this talk, I will present some progresses in the calculation of the out-of-equilibrium one-particle density matrix enabled by the framework of Quantum Generalized Hydrodynamics and comment on their experimental relevance. The focus will be mainly on the 1D Bose gas in the limit of strong repulsion (or Tonks-Girardeau limit).

Primary author: SCOPA, Stefano (LPTM - Cergy)

Presenter: SCOPA, Stefano (LPTM - Cergy)

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **101** Type: **Talk (20 min)**

Fast QSC Solver for Excited States

Wednesday, 6 September 2023 17:20 (20 minutes)

Spectrum of planar N=4 super Yang-Mills theory (SYM) is known to be exactly solvable from integrability, in principle. In practice, only a handful of states were solved non-perturbatively. We introduce a new integrability-based numerical tool called the Fast Quantum Spectral Curve (QSC) Solver, and using it, we solve the spectral problem for N = 4 SYM fully, systematically, efficiently and exactly. Our implementation allows to

1. find the spectrum for a wide range of t'Hooft coupling
2. initialise many states at weak cooling using already available perturbative data.

Using the QSC Solver, we were able to follow states from weak to strong coupling. We have computed all states of N=4 SYM with bare dimension < 7. In addition, we fit spectrum at strong coupling and analyse the outcome of these fits.

Finally, we break degeneracies of states at strong coupling, and this unlocks the possibility to use the recently proposed dispersive sum rules to extract some OPE coefficients at the leading order of the strong coupling expansion.

Primary authors: Dr HEGEDUS, Arpad (Wigner Institute); Dr JULIUS, Julius (King's College London); SOKOLOVA, Nika (King's College London); Prof. GROMOV, Nikolay (King's College London)

Presenter: SOKOLOVA, Nika (King's College London)

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **102** Type: **10 min Talk + Poster**

A fixed point approach to solve the generalized hydrodynamics equation

Monday, 4 September 2023 17:30 (10 minutes)

In this talk I will to present a novel approach to solve the (Euler scale) GHD equation. It consists of mapping the GHD equation onto an equivalent fixed point problem. This fixed point problem is remarkable in the sense that it completely decouples in space and time. Thus, given an arbitrary time t and a space point x, the fixed point equation determines the solution of the GHD equation directly at this point. This does not only give rise to a new efficient algorithm to solve the GHD equation, but also allows for a mathematical study of its solution: I will demonstrate its power by showing that solutions to the GHD equation of the (repulsive) Lieb-Liniger model always exist, are unique and do not show shock formation.

Primary author: HUEBNER, Friedrich (King's College London)

Co-author: DOYON, Benjamin (King's College London)

Presenter: HUEBNER, Friedrich (King's College London)

Session Classification: Gong Session for Posters

Contribution ID: **103** Type: **Talk (30 min)**

Sine-Gordon - a beautiful model of quantum fields

Tuesday, 5 September 2023 16:40 (40 minutes)

The sine-Gordon model is a paradigmatic quantum field theory due to its fascinating nonperturbative physics and integrability. Recently, it has gained direct experimental relevance in studying quantum dynamics. In this talk, I give a somewhat subjective overview of the results achieved and the challenges ahead, hoping to demonstrate that this 'beautiful model' certainly deserves continued interest.

Presenter: TAKACS, Gabor (Department of Theoretical Physics, Budapest Unitersity of Technology and Economics)

Session Classification: A nice and passionate journey in low-dimensional systems

Contribution ID: **104** Type: **Talk (30 min)**

How to get into an excited state

Tuesday, 5 September 2023 15:30 (30 minutes)

Presenter: DOREY, Patrick (Durham University)

Session Classification: A nice and passionate journey in low-dimensional systems

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

Chang Duality in Ginzburg-Landau Quantum Field Theories

Tuesday, 5 September 2023 16:00 (20 minutes)

We first Review Chang's derivation of a strong/weak duality in the paradigmatic ϕ^4 quantum field theory in (1+1)-dimension. We show how it is possibile to extend this concepts for general Ginzburg-Landau Theories and study in detail the ϕ^6 theory, proving the existence of a strong/weak duality. Such a duality links the strong coupling regime of the \mathbb{Z}_2 symmetric phase of the theory to the weak coupling regime of the \mathbb{Z}_2 spontaneously symmetry breaking Ising-like phase.

Presenter: POMPONIO, Octavio (Istituto Nazionale di Fisica Nucleare)

Session Classification: A nice and passionate journey in low-dimensional systems

Contribution ID: **106** Type: **Invited talk**

Entanglement and Quantum Information Classifiers for Quantum Phases of Matter

Tuesday, 5 September 2023 17:20 (20 minutes)

We will first review the role of entanglement for the identification and the classification of quantum phases of matter of low dimensional strongly correlated quantum systems to then move to describe some specific quantum information classifiers, in particular quantum Fisher information for local and local operators, to outline to what extent they can describe also multipartite entanglement and topological phases.

Presenter: ERCOLESSI, Elisa (Istituto Nazionale di Fisica Nucleare)

Session Classification: A nice and passionate journey in low-dimensional systems

Contribution ID: **136** Type: **Invited talk**

ODE/IM correspondence: Wall-crossing of TBA equations

Wednesday, 6 September 2023 11:10 (50 minutes)

We review the ODE/IM correspondence for higher-order ODEs associated with affine Toda field equations. We focus on the exact WKB periods and the TBA equations for higher-order ODEs and their wall-crossing phenomena, which describe a rich structure of the ODE/IM correspondence. We also discuss its supersymmetric extension and application to quantum mechanics with effective potential.

Primary author: ITO, Katsushi (Tokyo Institute of Technology)

Presenter: ITO, Katsushi (Tokyo Institute of Technology)

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **137** Type: **Invited talk**

A new long range fermionic integrable model.

Thursday, 7 September 2023 09:00 (50 minutes)

We are defining and studying a fermionic integrable model which is a long-range version of the XXZ model at $\Delta = 0$. The model can be obtained as the q=i limit of the q-deformed Haldane-Shastry model studied previously. Unlike its short-distance cousin, and very much like the Haldan-Shastry model, it possesses extended symmetry. The model is non-unitary and has unusual properties. In the even-site case N=2L all the energies are zero and the spectrum contains Jordan blocks of size up to L+1. In the odd-site case the one-magnon spectrum is linear.

Primary author: SERBAN, Didina

Presenter: SERBAN, Didina

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **138** Type: **Talk (20 min)**

U(1) entanglement asymmetry in the Ising CFT via non-topological defects

Thursday, 7 September 2023 15:00 (20 minutes)

The entanglement asymmetry quantifies how much a given state is far from being invariant under a certain group. If studied in the ground state of a system, it quantifies how much the system breaks (either explicitly or spontaneously) a given symmetry group. Formulated in the modern language, symmetries of a QFT are implemented by topological defects and, accordingly, the entanglement asymmetry quantifies how much such defects are not topological. We study the $U(1)$ entanglement asymmetry in the ground state of the Ising CFT. This boils down to the computation of the ground state energy of the Majorana theory on a circle with defects that couple the left and right chiral components. The resulting asymmetry matches with the universal subleading term that is numerically accessible on the lattice.

Primary authors: ARES, Filiberto (SISSA, INFN Trieste); DUBAIL, Jerome (Nancy); FOSSATI, Michele (SISSA e Istituto Nazionale di Fisica Nucleare); Prof. CALABRESE, Pasquale (SISSA, INFN Trieste, ICTP)

Presenter: FOSSATI, Michele (SISSA e Istituto Nazionale di Fisica Nucleare)

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **139** Type: **Talk (30 min)**

GGEs, modular transforms and defects

Tuesday, 5 September 2023 11:10 (30 minutes)

We present a physical interpretation and mathematical evidence for the modular transforms of GGEs that was discussed in arXiv:2111.13950. We presented a conjecture for the modular transform of the partition function of a simple GGE in a single free fermion model as a curious product over three apparently independent sets of fermion modes. We have now generalised the result to GGEs composed of arbitrary finite combinations of higher charges and can explain this result by treating the GGE as a defect line. As further evidence we show how a specialisation of our formula is equivalent to recent work of Zagier on so-called Power Partitions.

Primary authors: WATTS, Gerard (King's College London); Mr DOWNING, Max (King's College London)

Presenter: WATTS, Gerard (King's College London)

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **140** Type: **Talk (20 min)**

Wetting and entropic repulsion in two dimensions. Exact results from boundary field theory.

Thursday, 7 September 2023 12:20 (20 minutes)

The exact characterization of order parameter correlations in the presence of strongly fluctuating interfaces is a notoriously difficult problem in classical statistical mechanics. In this talk we present exact results for order parameter and energy density correlations for an interface forming a droplet in two dimensions whose endpoints are pinned on a wall. Our framework, which hinges on integrable boundary quantum field theories and general low-energy properties of two-dimensional field theories, applies to interfaces entropically repelled by a hard wall as well as to the regime of wetting transitions. In particular, we will show that for entropically repelled interfaces the finite extent of the sessile droplet yields finite-size corrections to one- and two- point functions. These corrections are interpreted as adsorption of bubbles and self-interaction of the interface, their exact form is identified, interpreted in terms of Brownian excursions, and successfully tested against high-precision Monte Carlo simulations in the absence of adjustable parameters. This analysis allows us to resolve a 40-years old discrepancy occurred in early Monte Carlo studies. The regime of wetting is also considered and in this case we show how the existence of a boundary bound state yields the dominant contribution to the one- and two-point functions, which we calculate exactly. We show that correlations are long-ranged for entropic repulsion and at wetting. For both the regimes we investigate correlations in momentum space by generalizing the notion of interface structure factor to semi-confined systems. Distinctive signatures of the two regimes manifest in the structure factor through a term that we identify on top of the capillary-wave one.

Based on

[1] A. S. and A. Tinti, Interfacially adsorbed bubbles determine the shape of droplets, J. Stat. Mech. (2023) 013206.

[2] A. S. and A. Tinti, Droplet-mediated long-range interfacial correlations. Exact field theory for entropic repulsion effects, Journal of High Energy Physics 123 (2023).

[3] A. S. and A. Tinti, Interfacially adsorbed bubbles determine the shape of droplets, to appear in SciPost (2023) [scipost 202302 00024v2].

Primary author: SQUARCINI, Alessio (Institute for Theoretical Physics, Innsbruck University)

Presenter: SQUARCINI, Alessio (Institute for Theoretical Physics, Innsbruck University)

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **141** Type: **Talk (20 min)**

Entanglement asymmetry in the ordered phase of many-body systems: the Ising Field Theory

Tuesday, 5 September 2023 12:00 (20 minutes)

Global symmetries of quantum many-body systems can be spontaneously broken. Whenever this mechanism happens, the ground state is degenerate and one encounters an ordered phase. In this study, our objective is to investigate this phenomenon by examining the entanglement asymmetry of a specific region.
We explicitly demonstrate our construction in the ordered phase of the Ising field theory in 1+1 dimensions, where a Z2 symmetry is spontaneously broken, and we employ a form factor bootstrap approach to characterise a family of composite twist fields. Analytical predictions are provided for the entanglement asymmetry of an interval in the Ising model as the length of the interval becomes large.

This is a joint work with Michele Mazzoni. Ref. arXiv:2307.12127

Primary author: CAPIZZI, Luca (Istituto Nazionale di Fisica Nucleare)

Presenter: CAPIZZI, Luca (Istituto Nazionale di Fisica Nucleare)

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **142** Type: **Talk (30 min)**

Sine-Gordon: from coupled condensates to hydrodynamics

Wednesday, 6 September 2023 15:20 (30 minutes)

The sine-Gordon model is an integrable field theory that captures the effective dynamics of a wealth of one-dimensional quantum systems, and thus is of central interest for a broad community. A convenient experimental platform consists of two tunnel-coupled onedimensional quasicondensates: the great tunability of this setup makes it a convenient quantum simulator of the field theory, realizing a sine-Gordon model with inhomogeneous couplings.
How does theory keep up with experimental challenges?
Generalized Hydrodynamics is a well-established framework to describe weakly-inhomogeneous integrable models: in this talk, I present an overview of the recent efforts by myself and collaborators to study the sine-Gordon model from a GHD perspective.

Primary author: BASTIANELLO, Alvise (Technican University of Munich)

Presenter: BASTIANELLO, Alvise (Technican University of Munich)

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **143** Type: **Talk (30 min)**

Integrated correlators with line defects

Thursday, 7 September 2023 09:50 (30 minutes)

One of the most attractive features of supersymmetric gauge theories is a striking cross-fertilization of distinct exact techniques, like integrability, bootstrap, and supersymmetric localization. In recent years, certain integrated correlators emerged as a natural incarnation of that interplay, leading to a new tool to probe the non-perturbative regime of those models. In this talk, I will introduce protected integrated correlators in the context of 3d theories, even in the presence of line defects. Then, I will explain how to implement the constraints from supersymmetric localization to compute correlation functions of local operators, with and without line operators. As an application, I will focus on the ABJM theory and relate integrated correlators to physical observables, like the central charge or the bremsstrahlung. The latter is also accessible from integrability, providing an explicit bridge between these two methods. The talk is based on 2112.13816 and 2301.07035.

Primary author: GUERRINI, Luigi (Istituto Nazionale di Fisica Nucleare)

Presenter: GUERRINI, Luigi (Istituto Nazionale di Fisica Nucleare)

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **144** Type: **Invited talk**

Gas of Bethe ansatz wavepackets and an ab initio derivation of generalised hydrodynamics

Monday, 4 September 2023 09:30 (50 minutes)

The hydrodynamic approximation is an extremely powerful tool to describe the behaviour of many-body systems such as gases. At the Euler scale, the approximation is based on the idea of local entropy maximisation: locally, within fluid cells, the system relaxes to a state that takes the Gibbs form. In conventional gases, these are thermal states, which include the few conserved quantities admitted by the model. In integrable systems, these are the so-called generalised Gibbs ensembles, which include the infinite set of conserved quantities, and the corresponding hydrodynamic theory is called generalised hydrodynamics (GHD). GHD applies for instance to experimentally realized one-dimensional interacting Bose gases described by the Lieb-Liniger model, and many more one-dimensional integrable systems, such as classical soliton gases and the hard-rod model. However, the local entropy maximisation is an assumption, and in general it is hard to establish the hydrodynamic equations from first principles (from the microscopic dynamics of the model). In this talk I will explain how to construct a gas of wavepackets in the Lieb-Liniger model, based on the Bethe ansatz form of the wave function. Their effective dynamics gives rise, without the assumption of local entropy maximisation, to the GHD equations. This provides a blueprint for proving the GHD equations from the Schroedinger equations. The main idea is a map to the scattering coordinates of the wavepackets' dynamics, and is similar in spirit to the techniques used in the known rigorous proof of the hydrodynamic equations for the hard-rod gas.

Primary authors: DOYON, Benjamin (King's College London); Mr HUEBNER, Friedrich (King's College London)

Presenter: DOYON, Benjamin (King's College London)

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **145** Type: **Talk (20 min)**

New insights into quantum affine Gaudin models

Monday, 4 September 2023 12:20 (20 minutes)

Quantum Gaudin models were introduced in 1976 to study integrable spin chains with long-range interactions. Since then, they have found many applications in modern mathematical physics.

The integrable structure of Gaudin models of finite type is very well understood, i.e., there is a precise description of the commutative subalgebra of the conserved charges, and their spectrum can be described with a generalisation of the ODE/IM correspondence, known as the Feigin-Frenkel-Reshetikhin (FFR) approach.

However, the same cannot be said for their affine counterparts, and in this talk, I will summarize some of the most recent results in this direction. In particular, I will describe the construction of a particular Vertex Algebra that could be useful for the generalization of the FFR construction in this context.

Primary authors: YOUNG, Charles (University of Hertfordshire, UK); FRANZINI, Tommaso (University of Hertfordshire)

Presenter: FRANZINI, Tommaso (University of Hertfordshire)

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **146** Type: **10 min Talk + Poster**

Integrability and exact solution of the multi-species non-equilibrium stirring process

Monday, 4 September 2023 17:20 (10 minutes)

The simple symmetric exclusion process (SSEP) is a well studied interacting particle system that consists of a random walk with an additional exclusion constraint that allows at most one particle per site. The system can be put out of equilibrium via interaction with reservoirs. An interesting question (also for applications like statistical mechanics) is to characterize the non-equilibrium steady state. In this direction much effort has been done and some techniques have been developed, for instance matrix product ansatz (MPA), stochastic duality and quantum inverse scattering method. Stochastic duality is a technique that relates the expectations of two Markov processes (the original and the dual one) via an observable called duality function. This implies a similarity transformation between the original Hamiltonian and the "simpler" dual one.
The aim of this talk is to extend the previous techniques to study a multi-species (multi-colour) version of the SSEP, namely the "stirring process". The idea is to use $gl(N)$ Lie algebra (where N is the number of different species) to construct the Hamiltonian and exploit its symmetries to find a duality relation. This duality relation allows to simplify the non-equilibrium problem and to apply efficiently a multi-variate version of MPA. As a consequence exact formulas for arbitrary point correlations in the non-equilibrium steady state are written. Moreover, we can map the stirring process to a higher rank version of the XXX-Heisemberg spin chain. Therefore, using Yang-Baxter-Equation, we construct a proper non-local similarity transformation that maps the eigenvector of the non-equilibrium Hamiltonian onto the equilibrium ones. This defines a connection between equilibrium and non-equilibrium situation, that also allows to find again the exact non-equilibrium steady state. Although integrability and MPA do not apply to higher spin situations, duality does. Finally, a reaction-diffusion version of the stirring process with the same duality relation can be introduced.
This talk is based on a work in progress that will appear soon on ArXiv.

Primary authors: Prof. GIARDINÀ, Cristian (Università di Modena e Reggio Emilia); CASINI, Francesco (Università di Modena e Reggio Emilia); Dr FRASSEK, Rouven (Università di Modena e Reggio Emilia)

Presenter: CASINI, Francesco (Università di Modena e Reggio Emilia)

Session Classification: Gong Session for Posters

Contribution ID: **147** Type: **Talk (30 min)**

Conformal field theory at the edge of Quantum Hall droplets

Thursday, 7 September 2023 10:20 (30 minutes)

I discuss several aspects related to the edge behavior of 2d integer quantum Hall droplets of arbitrary shapes, and its relation to two-dimensional Coulomb gases at a specific inverse temperature. Both systems can be mapped onto free fermions, with single particle wave functions which can be determined exactly in the limit of large particle number. It is well known that the two problems can be described by a simple conformal field theory, but I will discuss subtle differences between their correlation functions. If time permits I will also discuss how such edge modes can affect entanglement scaling.

Primary author: STÉPHAN, Jean-Marie (Institut Camille Jordan, CNRS)

Presenter: STÉPHAN, Jean-Marie (Institut Camille Jordan, CNRS)

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **148** Type: **Talk (20 min)**

Remarks on BPS Wilson loops in non-conformal N=2 gauge theories and localization

Thursday, 7 September 2023 12:00 (20 minutes)

We consider 1/2 BPS supersymmetric circular Wilson loops in $\mathcal{N} = 2$ $SU(N)$ SYM theories with massless matter content and non-vanishing β-function. In flat space we compute the observable via perturbative techniques, employing dimensional reduction to regularize the ultraviolet divergences and performing standard renormalization. We extend the analysis on the sphere $\mathbb{S}^4$ using both Feyman diagrams and the matrix model resulting from the localization procedure. On the matrix model side, working with a non-vanishing β-function requires a consistent regularization scheme to obtain a well-defined partition function. We show that at order g^4 a suitable procedure gives perfect agreement between localization predictions and standard perturbative renormalization. The results on $\mathbb{S}^4$ and those in flat space coincide for the Wilson loop at order g^4 even if conformal symmetry is broken at the quantum level, but we expect a mismatch at order g^6 due to an anomalous contribution which is generated by the renormalization procedure on the sphere and does not appear in $\mathbb{R}^4$.

Primary author: TESTA, Alessandro (Istituto Nazionale di Fisica Nucleare)

Co-authors: GRIGUOLO, Luca (Istituto Nazionale di Fisica Nucleare); BILLO', Marco (Istituto Nazionale di Fisica Nucleare)

Presenter: TESTA, Alessandro (Istituto Nazionale di Fisica Nucleare)

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **155** Type: **Talk (30 min)**

Integrability tools for gauge theory and black holes physics

Wednesday, 6 September 2023 10:20 (30 minutes)

In this talk, I will explain how to apply some integrability tools like QQ-system , TQ-relation or Thermodynamic Bethe Ansatz to some 4D N=2 gauge theories and realistic black holes models. In fact, those theories mathematically are completely characterised by some shared Ordinary Differential Equation (ODE) which we study through the celebrated ODE/IM correspondence with 2D Integrable Models (IM). We showed for example how integrability structures like QQ or TQ are naturally solved in terms of the N=2 gauge prepotential. In this way ODE/IM also sheds light on the recently found relation between N=2 SU(2) gauge theory and black holes physics, especially concerning the computation of quasinormal modes of gravitational waves through the gauge prepotential. We also found the Thermodynamic Bethe Ansatz to be a new convenient computational tool to this end. Based on arXiv:1908.08030, arXiv:2112.11434, arXiv:2208.14031 and arXiv:23.*** .

Primary authors: GREGORI, Daniele (Nordita); FIORAVANTI, Davide (Istituto Nazionale di Fisica Nucleare); Dr SHU, Hongfei (BIMSA); Prof. ROSSI, Marco (University of Calabria); Dr MAHANTA, Ratul (University of Bologna, INFN)

Presenter: GREGORI, Daniele (Nordita)

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **162** Type: **Invited talk**

Integrability and truncated spectrum approach for out-of-equilibrium dynamics

Wednesday, 6 September 2023 09:00 (50 minutes)

A big challenge of modern-day many-body theory is to expand the existing (mostly equilibrium) toolbox to treat out-of-equilibrium problems, for example quantum quenches. Results are predicated on the ability to compute overlaps between the initial state and eigenstates of the Hamiltonian that governs time evolution; such overlaps are unavailable in most cases. For integrable models, as often is the case, some detailed results can be extracted from specific cases. This talk will present a hybrid theoretical/numerical approach, inspired by the Truncated (Conformal) Spectrum Approach, to preferentially generate the states with high overlaps for a generic quantum quench starting from the ground state or an excited state of an initial Hamiltonian. We use these preferentially generated states, in combination with a "high overlap states truncation scheme" and a modification of the numerical renormalization group, to compute non-equilibrium dynamics following a quench in the Lieb-Liniger model.

Primary author: CAUX, Jean-Sébastien (University of Amsterdam)

Presenter: CAUX, Jean-Sébastien (University of Amsterdam)

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **164** Type: **Invited talk**

Diffusion, Thermalisation and Turbulence in generalised hydrodynamics

Monday, 4 September 2023 14:30 (50 minutes)

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Primary author: DE NARDIS, Jacopo

Presenter: DE NARDIS, Jacopo

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **165** Type: **Invited talk**

Thermodynamics, transport, and fluctuations in the sine-Gordon model

Wednesday, 6 September 2023 14:30 (50 minutes)

The sine-Gordon model is a paradigmatic quantum field theory that provides the low-energy effective description of many gapped 1D systems. Despite this fact, its complete thermodynamic description in all its regimes was lacking. In the talk, I will report the filling of this gap by deriving the Thermodynamic Bethe Ansatz framework that captures the thermodynamics of the model and serves as the basis of its hydrodynamic description. As a first application, I will present results on the Drude weight characterising the ballistic transport of the topological charge and demonstrate that its dependence on the value of the coupling features a fractal structure. I will also show recent results about the large-scale fluctuations of the topological charge and current.

Based on
https://arxiv.org/abs/2305.10495
https://arxiv.org/abs/2305.15474

Primary authors: NAGY, Botond (Department of Theoretical Physics, Budapest University of Technology and Economics); TAKACS, Gabor (Department of Theoretical Physics, Budapest Unitersity of Technology and Economics); KORMOS, Márton (Department of Theoretical Physics, Budapest University of Technology and Economics)

Presenter: KORMOS, Márton (Department of Theoretical Physics, Budapest University of Technology and Economics)

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **166** Type: **10 min Talk + Poster**

All regular 4×4 solutions of the Yang-Baxter equation

Monday, 4 September 2023 16:40 (10 minutes)

In recent years an indirect approach for classifying solutions to the Yang-Baxter equation has emerged, based on the Sutherland equations and the so-called boost operator. We describe this method, and show how it can be used to classify all regular solutions of size 4×4. Beyond the usual 6- and 8-vertex type solutions, we find several new R-matrices of non-difference form. All of these new R-matrices give rise to transfer matrices with a non-trivial Jordan block spectrum. One of them corresponds to a novel non-diagonalisable deformation of the XXX spin chain.

Primary authors: CORCORAN, Luke (Trinity College Dublin); DE LEEUW, Marius (Trinity College Dublin)

Presenter: CORCORAN, Luke (Trinity College Dublin)

Session Classification: Gong Session for Posters

Contribution ID: **169** Type: **Invited talk**

Inverse Scattering from Spectral Curves

Tuesday, 5 September 2023 09:00 (50 minutes)

Integrability equips models of theoretical physics with efficient methods for the exact construction of useful states and their evolution. Relevant tools for classical integrable field models in one spatial dimensional are spectral curves in the case of periodic fields and inverse scattering for asymptotic boundary conditions. Even though the two methods are quite different in many ways, they must be related by taking the periodicity length of closed boundary conditions to infinity.
Using the Korteweg-de Vries equation and the continuous Heisenberg spin field as prototypical classical integrable field models, we discuss and illustrate how data for spectral curves transforms into asymptotic scattering data. In order to gain intuition and also for concreteness, we review how elliptic states for these models degenerate into solitons at infinite length.

Primary author: BEISERT, Niklas

Presenter: BEISERT, Niklas

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **176** Type: **Invited talk**

From exact WKB analysis to instanton counting at strong coupling

Thursday, 7 September 2023 15:20 (50 minutes)

In this talk I will discuss how the framework of exact WKB analysis underlies a definition of instanton partition functions beyond weak coupling regimes. In the context of four-dimensional theories with extended supersymmetry exact computations of partition functions are made possible by localization techniques. On the one hand localization hinges on the existence of a Lagrangian description,which is only accurate in weakly coupled regions of moduli space. On the other hand, there are also many examples of non-Lagrangian quantum field theories, which cannot be studied through localization. This raises the question of what replaces the definition of the partition function of a quantum field theory in the broader setting, and how such an object may be computed. I will discuss a geometric definition of instanton partition functions based on the study of isomonodromic deformations of quantum curves associated to certain quantum field theories. I will argue that this definition encompasses the standard one at weak coupling, but also extends to strong coupling, where it is amenable to direct computation.

Primary author: LONGHI, Pietro

Presenter: LONGHI, Pietro

Session Classification: Bologna Workshop CFT-IM

Contribution ID: **178** Type: **not specified**

A colloquial overture on two birthdays

Tuesday, 5 September 2023 14:30 (20 minutes)

In a highly colloquial manner, I shall make few comments on two fundamental birthdays for theoretical physics.

Presenter: FORAVANTI, Davide

Session Classification: A nice and passionate journey in low-dimensional systems