SwissMAP Annual General Meeting

September 10 – September 13, 2023

Les Diablerets
(Maison des Congrès)

Raschid ABEDIN (ETH Zurich)

Title: Lie bialgebra structures on power series algebras

Abstract: *Many important infinite-dimensional Lie bialgebra structures can be completed to topological Lie bialgebra structures on the space of formal power series with coefficients in a simple Lie algebra. The latter are closely related to solutions of the classical Yang-Baxter equation with two spectral parameters. In this talk, we associate the aforementioned Lie bialgebra structures with coherent sheaves of Lie algebras on irreducible plance cubic curves. This connection is used to achive a classification of the former objects.*

Gianmichele BLASI (UNIGE)

Title: Exact finite-time current correlation functions: Connecting theoretical frameworks of quantum transport

Abstract: *The dynamics of a quantum system in contact with one or more environments can be explored by using different theoretical frameworks, such as master equation, scattering-matrix, Green's functions and Heisenberg equation of motion. The choice of analyzing the quantum dynamics within a given framework takes into account several factors, for instance the presence of interactions within the quantum system, the coupling strength between the system and environment, and the focus on either the steady state or the transient regime. In general, it is challenging to provide a unified perspective on these frameworks.In this work we clarify the role and status of these approaches by considering a minimal single-level quantum dot in a two-terminal setup, subject to voltage and temperature biases. We provide analytical expressions of the particle and energy currents and their associated current fluctuations, both in the steady-state and transient regimes. Exact results are obtained from the Heisenberg equation, which we then show to be consistent with the ones obtained within the scattering-matrix and master equation approaches in their respective regimes of validity.*

Lin-Qing CHEN (ETH Zurich)

Title: Quantum states of gravitational fields for quantum sources and the table-top experiment on verifying its quantum signature

Abstract: *The Gravity-Induced-Entanglement experimental proposal has brought the prospect of detecting the quantum signature of the gravitational field to the regime of the table-top experiments. We show that this phenomenon can be described by using a transparent quantum field theoretical formulation of electromagnetism and gravity in the field basis. The strength of such a description is that it explicitly displays the quantum superposition of macroscopically distinct states of the field. In the case of (linearised) quantum general relativity, this formulation exhibits the quantum superposition of geometries giving rise to the effect. (based on Quantum 7, 958 (2023)) I will then discuss the current work of constructing potential observables that could be used to verify the quantum signature of gravitational field in the future table-top experiments.*

Jean-Pierre ECKMANN (University of Geneva)

Title: Tumbling downhill along a given curve

Abstract:

Antoine GAGNEBIN (ETH Zurich)

Title: Landau damping for Vlasov-type system

Abstract: *I will talk about Vlasov-type equations on the torus $\mathbb{T}^d$, PDE's that model confined plasma physics when you neglect collisions between particles and external magnetic effects. I will talk about a class of equilibria for such equations and look at the asymptotic stability in time for this kind of equilibrium. I will present the famous work of Landau (1946) concerning linear evolution and then give a new result for the asymptotic stability of the dynamic of ions in plasma.*

Martin HAIRER (EPFL)

Title: Noise-induced instability in the Lorenz system

Abstract:

Dmitrii KRACHUN (IAS)

Title:

Abstract:

Charles MARTINEZ (G-Research)

Title:

Abstract:

Pietro PELLICONI (University of Geneva)

Title: Black holes as open holographic systems and unitary dynamics

Abstract: *The black hole information paradox can be studied using the language of open quantum systems, where a system (the hawking radiation) interacts with an environment (the EFT of gravity). We start by considering generic open quantum systems in the context of EFTs. The effect of the environment in the theory can be taken into account introducing a functional in the path integral, the Influence Functional. This gives the open effective field theory of the system. We then show how to compute the entanglement entropy of the system effective action using the replica trick. Applying the same machinery to an evaporating black hole gives an entanglement entropy which is not consistent with unitarity. We then propose another prescription to obtain the Influence Functional for gravitational theories that is able to produce an entanglement entropy for Hawking's radiation consistent with unitarity. We conclude discussing a possible microscopic interpretation of the result.*

Francesco RIVA (University of Geneva)

Title: Microscopic Bounds on Macroscopic Theories

Abstract: *I will discuss Effective Field Theories that can originate from microscopic unitary theories, and their relation to moment theory. I will show that massive gravity, theories with isolated massive higher-spin particles, and theories with very irrelevant interactions, don't posses healthy UV completions.*

Alberto ROLANDI (University of Geneva)

Title: Collective advantages in finite-time thermodynamics

Abstract: *A central task in finite-time thermodynamics is to minimize the excess or dissipated work, W_{diss}, when manipulating the state of a system immersed in a thermal bath. We consider this task for an N-body system, whose constituents are identical and uncorrelated at the beginning and end of the process. In the regime of slow but finite-time processes, we show that W_{diss} can be dramatically reduced by considering collective protocols in which interactions are suitably created along the protocol. This can even lead to a sub-linear growth of W_{diss} with N : $W_{diss}\tilde{N}^x$ with $x < 1$; to be contrasted to the expected $W_{diss}\tilde{N}$ satisfied in any non-interacting protocol. We derive the fundamental limits to such collective advantages and show that $x = 0$ is in principle possible, which however requires highly non-local N-body interactions. We then explore collective processes with realistic many-body interacting models, in particular a 1D spin chain and an all-to-all spin model, achieving noticeable gains under realistic levels of control. As an application of these results, we focus on the erasure of information in finite time, and prove a faster convergence to Landauer's erasure bound.*

Chiara SAFFIRIO (University of Basel)

Title: Many interacting particles and their effective theories: the case of Fermions in the mean-field and semiclassical regimes.

Abstract: *The derivation of effective macroscopic theories approximating microscopic systems of interacting particles in some scaling limit is a major question in non-equilibrium statistical mechanics. In this talk we will be concerned with the dynamics of systems made of many interacting fermions and focus on the mean-field regime, i.e. weakly interacting particles whose collective effect can be approximated by an averaged potential in convolution form. As a first step we will obtain a reduced description given by the time-dependent Hartree-Fock equation. As a second step we will look at longer time scales, where a semiclassical description starts to be relevant, and approximate the many-body dynamics with the Vlasov equation, which describes the evolution of the effective probability density of particles on the one particle phase space. The structure of the initial data will play an important role at each step of the approximation.*

Adrian SANCHEZ GARRIDO (University of Geneva)

Title: The day Aleksey Krylov fell into a black hole

Abstract: *In this talk I will give an overview of the field of Krylov complexity, which has been recently of interest for the many-body and quantum physics communities, as well as for high-energy theorists. I will present various aspects of Krylov complexity that make it attractive, starting from its well-definedness as a notion of quantum complexity, and focusing on the lines of research that have occupied my thesis work, namely its suitability as a probe*

of quantum chaos, and the possibility to use it as an item in the holographic dictionary to describe the growth of the wormhole throat in the framework of the AdS/CFT correspondence.

Olga TRAPEZNIKOVA (University of Geneva)

Title: Parabolic bundles and the topology of singular moduli spaces

Abstract: *The moduli spaces of vector bundles on Riemann surfaces play an important role in a wide range of subjects: from enumerative geometry to non-abelian gauge theories in physics. While in the smooth (coprime) case, the topology of these spaces has been well understood, in the singular (degree-0) case, the enumerative structure remains mysterious. In this talk, I will present recent work showing how a classical tool: parabolic vector bundles may be used to deduce new results on the topological invariants of degree-0 moduli spaces.*

Jakub VOSMERA (ETH Zurich)

Title: Topological defect lines in symmetric-product orbifolds and tensionless holography

Abstract: *We investigate certain maximally-symmetric realizations of topological defect lines in the symmetric-product orbifold CFTs. In the particular case when the seed CFT is taken to be the theory of four free fermions and bosons on a 4-torus, we identify the* AdS_3 *string worldsheet duals of various defect configurations in the 2d spacetime CFT.*

Klaus WIDMAYER (UZH)

Title: Stable dynamics in Vlasov-Poisson - Landau damping

Abstract: *We discuss certain stable dynamics in the Vlasov-Poisson equations on* $\mathbb{R}^3$*, a classical model for unconfined, collisionless plasmas. Beginning with an overview of the status quo, we focus on a classical setting already investigated by Landau in 1946: the stability of spatially homogeneous equilibria. In what was long considered a puzzling phenomenon but is nowadays regarded as a classical effect in plasma physics, here one observes a "damping" mechanism, even though the dynamics are completely time-reversible. However, this alone is not enough to guarantee nonlinear stability: oscillatory effects play a crucial role.*