Beyond Gibbsianity

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Abstracts

ALEXANDRE BORITCHEV (Institut Camille Jordan, Lyon)

Burgers Turbulence: Uniform Bounds and the Stationary Measure

The Kolmogorov 1941 theory (K41) is, in a way, the starting point for all models of turbulence. In particular, K41 and corrections to it provide estimates of small-scale quantities such as increments and energy spectrum for a 3D turbulent flow. However, because of the well-known difficulties involved in studying 3D turbulent flows, there are no rigorous results confirming or infirming those predictions.

Here, we consider a well-known simplified model for 3D turbulence: Burgulence, or turbulence for the 1D or multi-dimensional potential Burgers equation. In the space-periodic case with a stochastic white in time and smooth in space forcing term, we give sharp estimates for small-scale quantities such as increments and energy spectrum. We highlight the link between those and the stationary measure.

LAURENT BRUNEAU (Labo AGM, Cergy)

About Entropic Fluctuations in Quantum Statistical Mechanics

Since the seminal works of Evans, Searles, Gallavotti and Cohen in the early 90's the study of entropic fluctuations has encountered a fast growing interest in the last decades, and many developments at least in classical systems. Its quantum counterpart however turned out to be very challenging. It has further been realized that the two time measurement protocol, introduced independently by Kurchan and Tasaki in 2000, sheds a new light on the problem making a connection between two-time measurement entropy production and phase space contraction of modular theory.

In this talk we further relate both the two-time measurement entropy production and quantum phase contraction to ancilla state tomography. We also consider the dynamical stability of these identifications. This opens a way to a possible quantum formulation of the Gallavotti-Cohen fluctuation relation.

This talk is based on a joint work with T. Benoist, V. Jakšić, A. Panati and C.-A. Pillet.

NOÉ CUNEO (LPSM, Paris)

Repeated Quantum Measurement Processes: Time Reversal, Large Deviations and Singularities

This is part 1 of a joint talk with T. Benoist. After a short mathematical introduction to repeated quantum measurement processes, we will focus on the probability distribution of the sequence of measurement outcomes. We will limit ourselves to the case where all measurements take values in a finite set. As we shall see through a series of examples, the resulting distributions range from familiar (i.i.d., Markov, ...) measures to highly singular, non-Gibbsian ones. We will explore some of the singularities from the point of view of the large deviations of entropy production.

TRISTAN BENOIST (Institut de Mathématiques de Toulouse)

Repeated Quantum Measurements: Examples and Quantum Detailed Balance

Following Noé Cuneo's talk on the general theory of entropy production for repeated quantum measurements, I will discuss several mathematically and physically relevant examples. After the presentation of canonical examples as a warmup, I will discuss two examples illustrating the richness of the probability measure family. First, I will show that the pressure (or cumulant generating function) can exhibit a whole zoo of irregularities outside (0,1). Then, I will detail an example where the pressure is not twice differentiable at 0 and 1 and the usual CLT fails, and so does fluctuation-dissipation relation. I will pursue with more physically straightforward examples where the entropy production can directly be expressed in terms of heat currents. I will discuss in details the implications of our results and, if time remains, discuss the relationship between vanishing of entropy production and different notions of quantum detailed balance.

JÜRG FRÖHLICH (ETH Zürich)

The Classical Periphery of Quantum Mechanics — The Appearance of Particle Tracks in Detectors

In this talk I consider regimes of Quantum Mechanics that can be described in classical terms. Such regimes constitute what I call the "Classical Periphery/Skin of Quantum Mechanics." I wont develop general theory, but illustrate it in a study of tracks of quantum-mechanical particles close to classical point-particle trajectories that are made visible in detectors. I will also offer some general comments on the notion of "events" in Quantum Mechanics and their role in understanding "state reduction" (ETH-Approach to QM), as it becomes manifest in measurements and observations.

ALAIN JOYE (Institut Fourier, Grenoble)

Adiabatic Lindbladian Evolution with Small Dissipators

We consider a time-dependent small quantum system weakly coupled to an environment, whose effective dynamics we address by means of a Lindblad equation. We assume the Hamiltonian part of the Lindbladian is slowly varying in time and the dissipator part has small amplitude. We study the properties of the evolved state of the small system as the adiabatic parameter and coupling constant both go to zero, in various asymptotic regimes.

HANS MAASSEN (Radboud University, Nijmegen, and University of Amsterdam)

Infinitely Divisible Instruments: Continuous Observation

Holevo's 1986 theorem on infinitely divisible instruments is a far-reaching generalization of the well-known Lévy-Khinchin formula for infinitely divisible probability distributions. It expresses the folk wisdom that any stationary quantum trajectory can be built up from Davies counting processes and a state diffusion. While preparing a textbook version of this theorem we found a more elementary proof, using a more transparant condition on the density of quantum jumps.

MARCO MERKLI (Memorial University of Newfoundland, St. John's)

On the Markovian Approximation

Approximating the dynamics of an open quantum system by a Markovian semigroup, or the Markovian master equation, is a standard procedure in quantum theory. We present a rigorous treatment, based on the theory of quantum resonances. While Davies' weak-coupling approach guarantees the validity of the Markovian approximation for finite times at fixed coupling strengths, the current method allows to show it for all times, as well as for correlated initial states.

CLÉMENT PELLEGRINI (Institut de Mathématiques de Toulouse)

Strong Noise in Quantum Measurement

Quantum trajectories describe the evolution of a quantum system undergoing indirect measurement. They are stochastic processes satisfying jump-diffusion evolutions. In the limit of strong noise (corresponding to strong measurement) they exhibit non standard evolution. The first pioneering and rigorous works in this field are due to M. Bauer, D. Bernard and A. Tilloy. They have presented the limiting process called spike process as jump processes decorated by spikes. In this talk I will present the complete and rigorous convergence of quantum trajectories to this spike process.

CHARLES PFISTER (EPF Lausanne)

Gibbs Measures on Compact Ultrametric Spaces

This talk is about the equivalence of Gibbs and Gibbs conformal measures for a dynamical system (G, X) when G is a countably infinite discrete group acting expansively on a compact ultrametric space X. As an application one obtains that for any beta-shift the equilibrium measure for a function of summable variation is a Gibbs measure.

CLAUDE-ALAIN PILLET (CPT–Toulon)

Some Thoughts on Approach to Equilibrium

Inspired by the successes of algebraic quantum statistical mechanics in dealing with some fundamental nonequilibrium questions, we investigate the relation between "approach to equilibrium" (sometimes called the Zeroth Law) and the Second Law. Short of being able to provide a new example of non-trivial and physically pertinent system approaching equilibrium, we bring some partial answers to a question raised by David Ruelle in 1967.

This is a joint work with Vojkan Jaksic and Clément Tauber.

RENAUD RAQUÉPAS (Labo AGM, Cergy)

Repeated Quantum Measurements and Universal Estimation of Entropic Quantities

The probability measures that can arise from a repeated quantum measurement protocol form a large family of measures on shift spaces (spaces of allowed sequences of outcomes). This family extends beyond the range of applicability of some foundational results in the study of entropic quantities, which rely on either some strong mixing or Markovianity assumption. In this talk, I will first focus on the ability to estimate the relative entropy between two sources, that need not be neither Markovian nor mixing, when only given a (long) sequence of outcomes from each source. I will then discuss the application of a positive result on the matter to the problem of estimating the entropy production associated to a repeated quantum measurement protocol.

The results I will focus on were obtained in collaboration with G. Cristadoro, M. Degli Esposti and V. Jakšić, but are closely related to past and ongoing projects with other speakers at this conference.

ARMEN SHIRIKYAN (Labo AGM, Cergy)

Kifer's Criterion for LDP: Simple Proof and Application

About thirty years ago, Kifer gave a sufficient condition for validity of LDP for a sequence of random probability measures on a compact metric space. In this talk, I shall present a simple proof of that result, which can easily be extended to the non-compact case. I shall also discuss an application of Kifer's criterion to Markov processes without strong Feller property.

This talk is based on joint works with V. Jakšić, V. Nersesyan, and C.-A. Pillet.

EVGENY VERBITSKIY (Leiden University)

Thermodynamic Formalism for Gibbsian and non-Gibbsian States

In this overview talk I will discuss

- various notions of Gibbsianity in Statistical Mechanics and Ergodic Theory,
- preservation and loss of Gibbs property under renormalization,
- variational principles for Gibbs and non-Gibbs states.