1. **Tristan Benoist** (LPT Toulouse) - *Heat and work full counting statistics in the adiabatic limit*

   Introductory lectures on classical thermodynamics deal mainly with quasi-static processes. The system state is assumed to evolve by following its instantaneous equilibrium. The equivalent limit in the microscopic description of systems is the adiabatic limit. In this limit a parameter of the system is slowly changed with respect to time scale of the evolution.
   Applying the quantum adiabatic theorem [AE, Teu] to finite dimensional Hilbert space systems does not lead in general to the quasi-static transition of a thermal state to the one expected. But in [JP] it has been proven that for thermodynamic systems and under a general stability assumption, the adiabatic limit actually leads to a quasi-static transition between two thermal states at the same temperature. From this result the authors of [JP] particularly obtained the saturation of Landauer's bound in the adiabatic/quasi-static limit.
   In this talk I will present further results consequence of the adiabatic limit for thermodynamic thermal states. I will particularly focus on the adiabatic limit for the full counting statistics (FCS) of both the work and the heat. The FCS is the statistics of a two-time measurement, one before the evolution of the system and one after. The heat or work is then the difference between the two measurement results.
   In the framework of Tomita-Takesaki modular theory, the work and heat FCS can be obtained as spectral measures of specific relative modular operators. Using the properties of modular operators we show the convergence of the heat and work FCS in the adiabatic limit. From the convergence of the heat FCS we derive the saturation of Landauer's bound at the statistical level in the state erasure setup. Particularly we show how large fluctuations appear in the thermal bath energy measurement when the final memory state is close to a pure one. From the convergence of the work FCS we obtain a refinement of Jarzynski's equality.
   This is a joint work with M. Fraas, V. Jaksic and C.-A. Pillet.
   References:
   [AE] Avron, J., and Elgart, A.: Adiabatic theorem without a gap condition. Commun. Math. Phys. 203, 445–463 (1999).
   [JP] Jaksic, V., and Pillet, C.-A.: A note on the Landauer principle in quantum statistical mechanics. J. Math. Phys. (2014).
   [RW] Reeb, D., and Wolf, M.M.: An improved Landauer principle with finite-size corrections. New J. Phys. 16 103011 (2014).
   [Teu] Teufel, S.: A note on the adiabatic theorem without gap condition. Lett. Math. Phys., 58, 261–266 (2001).

2. **Gregory Bulnes Cuetara** (University of Luxembourg) - *Stochastic thermodynamics of rapidly driven quantum systems*

   Stochastic thermodynamics provides a theoretical famework for the investigation of fluctuating thermodynamic quantities at the mesoscale and below. It has been succesfully applied to open quantum systems described by a stochastic master equation in the system energy eigenbasis, such as autonomous or slowly driven systems.
   Quite remarkably, a stochastic description can be used in order to describe quantum system driven by a fast and time-periodic external driving. The corresponding master equation though, rules the populations of the system in its so-called Floquet states which do note have definite energy in general. This fact has interesting consequence on the thermodynamic properties of the system such as modifications of the local detailed balance, or the dependence of the work distribution on system coherences in the Floquet basis. Nevertheless, the existence of a stochastic description in the Floquet basis enables us to apply standart results of stochastic thermodynamics thus extending its range of applicability.

3. **Omar Fawzi** (ENS Lyon) - *The quantum conditional mutual information: properties and applications*

   The positivity of the quantum conditional mutual information is one of the fundamental theorems in quantum information theory. In these lectures, I am planning to talk about recent strengthenings of this inequality. These inequalities can be understood as showing that states with small conditional mutual information correspond to states that satisfy a Markov condition approximately. I am planning to mention also some applications of the result to entanglement theory. It will be mainly based on the paper http://arxiv.org/abs/1410.0664.

4. **Maria Jivulescu** (UPT Timisoara) - *Thresholds for entanglement criteria in quantum information theory*

   The problem of separability of random bipartite quantum states is studied from the point of finding and comparing thresholds points for different entanglement criteria. Our results complete the picture of thresholds points for reduction and absolute reduction criteria, in different asymptotic regimes. In addition, lower and upper approximations of the set of separable states are presented and studied from different perspectives (characterization and thresholds). The results presented are joint work together with Nicolae Lupa, Ion Nechita and David Reeb.

5. **Cécilia Lancien** (University of Lyon) - *De Finetti reductions and parallel repetition of multi-player non-local games*

   Roughly speaking, de Finetti type theorems allow to reduce the analysis of permutation-invariant scenarios to that of i.i.d ones. In this talk, I will present certain variants of such de Finetti reductions, and show how they can be used to study the parallel repetition of multi-player non-local games. More precisely, the problem one usually wants to solve in this context is the following: if players sharing certain physical resources cannot win one instance of a game with probability 1, does their probability of winning n instances of this game at the same time goes to 0 exponentially fast? Perhaps surprisingly, the answer to this question is not trivially "yes", even though I will show that, e.g. in the case of no-signalling correlations between the players, it is indeed "yes" in (almost) full generality. This talk will be based on joint work with Andreas Winter, appearing mostly in arXiv[quant-ph]1506.07002.

6. **Martí Perarnau Llobet** (ICFO, Barcelona) - *Work and entropy production with Generalized Gibbs Ensembles*

   The standard notions of thermodynamics rely on the fact that systems in nature equilibrate towards the Gibbs or thermal state. However, it is known that this does not hold true in every interacting quantum system. Relevant cases are integrable models, where the local effective equilibrium states are described by the marginals of so called Generalized Gibbs Ensembles (GGE) instead of Gibbs states. In this work we study fundamental questions in thermodynamics, focusing on reversibility, entropy production, and optimal processes for work extraction, in settings where the state of system and bath are described by GGE states. We recover standard results in Gibbs thermodynamics, such as the relation between slow processes and reversibility. However, unlike the Gibbsian case, in which the optimal protocol for work extraction is the one with minimal entropy production, we find that this link is not always true with GGEs. Finally, we compare our effective description using GGE states with the real unitary dynamics, finding an excellent agreement.

7. **Claude Alain Pillet** (CPT, University of Toulon) - *The Landauer Principle in quantum statistical mechanics*

   In a celebrated 1961 paper, Landauer formulated a fundamental lower bound on the energy dissipated by computation processes. Since then, there have been many attempts to formalize, generalize and contradict Landauer's analysis. The situation became even worse with the advent of quantum computing. In a recent enlightening article, Reeb and Wolf set the game into the framework of quantum statistical mechanics, and finally gave a precise mathematical formulation of Landauer's bound. I will discuss parts of this analysis and present some extensions of it that were obtained in a joint work with V. Jaksic.

8. **David Reeb** (ITP, Hannover) - *Landauer's Principle and finite-size effects in quantum thermodynamics (I)*

   This lecture will introduce Landauer's Principle, which puts energy constraints on information erasure processes and constitutes an essential link between thermodynamics and information theory. After reviewing traditional formulations and justifications of the Principle, I will present a rigorous and improved formulation under minimal assumptions, mainly in the finite-dimensional setting. This will allow to investigate optimality questions and yields explicit strengthenings of Landauer's Principle depending on the size of the heat reservoir. It also illuminates the achievability of Landauer's bound which I will discuss as well. After examining related issues such as Maxwell's Demon and the erasure of correlations in the same framework, if time permits I will mention other proposals in quantum thermodynamics of formulating Landauer's Principle and of accounting for energy/work.

9. **Francesco Ticozzi** (University of Padua) - *Generating Entanglement from Frustration-Free Dissipation*

   Dissipative dynamics in quantum open systems allow the system state to converge to asymptotically stable equilibria, cycles or sets with richer structure. Studying such asymptotic behavior is of key interest for the analysis of complex quantum dynamics and the synthesis of engineered dissipation, with application to state preparation, dissipative encodings in protected codes and engineering of effective samplers. In particular, we investigate which states can be made asymptotically stable with quasi-local frustration-free dynamics, where limited groups of subsystems in a multipartite system are allowed to interact, and obtain characterizations of stabilizable pure states and full-rank states. The scope and limits of the results will be illustrated by some examples of stabilizable entangled states, conjectures and open problems.

10. **Antoine Tilloy** (ENS Paris) - *A toy model of classical measurement and the thermodynamics of quantum trajectories*

    I will introduce a toy model which is a classical analog of continuous quantum measurement schemes. The objective of this approach will be to have a simple model in which all the quantities can be understood in an intuitive way (where the notions of information, work, uncertainty etc. are defined in an unambiguously) but which is close enough from quantum mechanics to give useful insights. After discussing the basic properties of the toy model, I will propose some applications to the understanding of quantum jumps, past quantum states, and will eventually try to do a constructive criticism of the current approach to the thermodynamics of quantum trajectories.