ArpiLYSM II – Program of Talks

Hotel Cavalier d'Arpino, Arpino | 10–14 November 2025

Monday 10

Time	Speaker	Title
17:00 – 17:20	Lorenzo Baroni	*Linear flow on the infinite torus.*
17:20 – 17:40	Diego Fiorletta	*Dynamical Amrein–Berthier Uncertainty for fractional Schrödinger equations and its linear vs non-linear phases in oscillatory integrals but still Dynamical Amrein–Berthier Uncertainty.*
17:40 – 18:00	Vincenzo Rossi	*Linear VS Non-linear in the classical and quantum Hall effect.*
18:00 – 18:20	Riccardo Borsetto	*An Agda framework for Model Extended Sequents.*
18:20 – 18:30	Final Discussion	

Tuesday 11

Time	Speaker	Title
17:00 – 17:20	Emilie Uthaiwat	*The lambda calculus as a 2-dimensional operad.*
17:20 – 17:40	Rémi Di Guardia	*Bayesian Networks and Proof-Nets: the proof-theory of Bayesian Inference.*
17:40 – 18:00	Thomas Waring	*Paradoxes & Normalisation in Natural Deduction.*
18:00 – 18:20	Vincent Boulard	*Geometric observability estimates for abstract heat equations.*
18:20 – 18:40	Thomas Borsoni	

Thursday 13

Time	Speaker	Title
17:00 – 17:20	Stefano Catozi	*Some quantitative results on the execution time of λ-calculus.*
17:20 – 17:40	Riccardo Piombo	*Optimal Transport at non-zero Temperature: exploring the inherent sub-optimality of real-world networks.*
17:40 – 18:00	Giacomo Principali	*The Elasticity of Demand: Measuring Consumer Sensitivity to Changes in Goods Prices.*
18:00 – 18:20	Ariadne Si Suo	
18:20 – 18:30	Final Discussion	

Abstracts

Lorenzo Baroni (Università degli Studi Roma Tre, Rome)

Title: Linear flow on the infinite torus

This talk is concerned with linear flows on the infinite torus. The work is motivated by the fact that many Hamiltonian PDEs admit invariant tori, of possibly infinite dimension, on which the dynamics is linearizable. The finite-dimensional case is well understood: the dynamics can be reduced to a "non-resonant" flow on a subtorus, which is equivalent to being topologically transitive, to minimality, and to unique ergodicity in the projection. We prove that this characterization still holds when the dimension of the torus is infinite if and only if the integer (finite) linear combinations of the frequencies form a free abelian group. We also construct a class of orbits whose closure is locally homeomorphic to the product of a ball and a Cantor set and we show that the Benjamin-Ono equation admits this type of solutions. Time permitting, we shall discuss the equivalence between a classification problem for linear flows and that for countable abelian groups without torsion.

Diego Fiorletta (Università La Sapienza, Rome)

Title: Dynamical Amrein–Berthier Uncertainty for fractional Schrödinger equations and its linear vs non-linear phases in oscillatory integrals but still Dynamical Amrein–Berthier Uncertainty

(Based on a joint work and a work in progress with Piero D'Ancona).
The Uncertainty Principle in Fourier Analysis is a heuristic principle which, roughly speaking, says that the more a function is localized, the less its Fourier transform is, and vice versa. On the other hand, a Dynamical Uncertainty Principle also holds: the more the initial datum of some evolutionary PDE (e.g. Schrödinger) is localized, the less its evolution observed at a second time $T > 0$ is. I will focus on an adaptation of a statement of the Uncertainty Principle by Amrein and Berthier (a function and its Fourier transform cannot be both localized over sets of finite measure) in the setting of fractional Schrödinger equations, $i\partial_t u(x,t) = (-\Delta)^\alpha u(x,t), (x,t) \in \mathbb{R}^n \times \mathbb{R}, \alpha > \frac{1}{2}$. In particular, I will discuss a main point in the proof strategy, concerning the compactness of the localized propagation operator. Such operator exhibits an integral representation, whose kernel is given by an oscillatory integral involving e $e^{-it\lambda^\alpha}$. I will show differences and similarities between the "linear" phase scenario ($\alpha = 1$, free Schrödinger equation) and the "non-linear" one ($\frac{1}{2} < \alpha \neq 1$).

Vincenzo Rossi (GSSI, L'Aquila)

Title: Linear VS Non-linear in the classical and quantum Hall effect

In this talk we will discuss the Hall effect, a physical phenomenon that occurs in two-dimensional electron gases subject to a constant magnetic field, with an induced electric current driven through the sample. The classical theory predicts a linear dependence of

the electrical conductivity of the system on the magnetic field. However, the quantum picture reveals the emergence of interesting types of non-linear behaviours, in contradiction with the classical prediction. In order to give an intuition behind this phenomenon, we will introduce a mathematical model describing the experimental setting, called the Landau model, and study the role of topology in explaining the quantum Hall effect.

Riccardo Borsetto (Università di Verona, Verona)

Title: An Agda framework for Model Extended Sequents

Emilie Uthaiwat (Aix-Marseille Université, Luminy)

Title: The lambda calculus as a 2-dimensional operad

What does it mean for two programs to be equal? Works in the literature have shown that by exhibiting the categorical structure of programs, computational equivalence qualifies as an appropriate notion of equality between them. In fact, we think that programs (and program executions) have a richer 2-dimensional, multicategorical structure which takes into account equality between executions. This talk has therefore two aims:

1) Cover the characterization of equality between programs in order to anchor the research project.

2) Give a taste of the approaches which should yield a categorical presentation of equality between program executions.

Rémi Di Guardia (IRIF-CNRS, Paris)

Title: Bayesian Networks and Proof-Nets: the proof-theory of Bayesian Inference

Bayesian Networks are a graphical syntax describing probability distributions compactly by following dependencies of variables. I will present the correspondence between these Bayesian Networks and Proof Nets, a graphical syntax for proofs in linear logic. Uses of such a correspondence are giving a proof-theoretical account of Bayesian inference (in the spirit of the Curry-Howard correspondence), and exploiting the expressivity of Proof Nets to get compositional graphical methods where each intermediate graph is associated to a probability distribution. (Join work with Thomas Ehrhard and Claudia Faggian.)

Thomas Waring, (Università degli Studi Roma Tre, Rome)

Title: Paradoxes & Normalisation in Natural Deduction

The Curry-Howard correspondence exhibits a tight correspondence between proofs and programs. In this talk, I will outline how this plays out in Gentzen's system of natural deduction, & show how this formalism can present Russell's paradox as a non-terminating

computation. I will sketch how this relates to the theme of (non-) linearity, & how it inspired the development of a "logic of polytime".

Vincent Boulard, (CERMICS et LJLL, Paris)

Title: Geometric observability estimates for abstract heat equations

We address a long-standing open question posed by Ervedoza and Zuazua concerning a geometric bound on the exponential rate in infinite time integrated observability inequalities for heat equations. Our work establishes this geometric bound in a general abstract setting encompassing a wide variety of operators, including hypoelliptic Laplacians on sub-Riemannian manifolds. The result follows from a unified framework combining finite-speed propagation principles, local spectral asymptotics, and ultracontractivity estimates, providing a comprehensive understanding of sharp observability across diverse geometric contexts.

Stefano Catozi (Aix-Marseille Université, Luminy)

Title: Some quantitative results on the execution time of λ-calculus

The lambda-calculus is a formal system describing computation and is the theoretical foundation of functional programming languages. Abstract machines are tools used to study the evaluation of lambda-terms. In this talk, we will outline the connection between the lambda-calculus and Linear Logic, which provides a framework for reasoning about resources and their duplication. We will then present an overview of several results that use tools from Linear Logic to establish complexity bounds on the execution time of abstract machines implementing the lambda-calculus.

Riccardo Piombo (CREF, Rome)

Title: Optimal Transport at non-zero Temperature: exploring the inherent sub-optimality of real-world networks

Real systems — like ecological and economic networks — rarely achieve perfect optimization. Acknowledging this inherent sub-optimality, we develop a Maximum Entropy model of Optimal Transport with a non-zero temperature, where randomness and cost minimization coexist. This framework introduces a continuous transition from random dense configurations to sparse efficient structures, controlled by a single parameter, β. By capturing how near-optimal networks organize under realistic constraints, the model provides a unified description of structure formation in complex systems.

Giacomo Principali (Università degli Studi di Perugia, Perugia)

Title: The Elasticity of Demand: Measuring Consumer Sensitivity to Changes in Goods Prices

This talk will discuss the concept of price elasticity of demand. This measure is used to estimate how sensitive consumers are to changes in the price of a good. After a formal introduction of the concept of elasticity through its mathematical definition, several notable cases will be examined. Subsequently, other interpretations of the concept of elasticity will be presented. The final part of the talk will be devoted to the generalization of the concept of arc elasticity, highlighting the consistency of this definition with the one previously introduced.