Journée de rentrée de l'équipe ANH
Scientific program

October 7, 2025

09 : 30 – 10 : 15	Leo Mandô. *The regularity problem for degenerate elliptic operators.*
10 : 15 – 11 : 00	Longteng Chen. *Kähler-Ricci flow on asymptotically conical gradient Kähler-Ricci expanders—uniqueness and stability.*
11 : 00 – 11 : 45	Baadi Khalid. *On Hardy-Littlewood-Sobolev Estimates for Degenerate Laplacians.*
11 : 45 – 14 : 00	Déjeuner/Lunch.
14 : 00 – 14 : 45	Joseph Feneuil. *Lipschitz perturbations that perserve the L^p solvability of the Dirichlet problem.*
14 : 45 – 15 : 30	Romain Cretier. *Distributions, Tanaka's prolongation and Lie algebras of vector fields.*
15 : 30 – 16 : 15	Bastien Lecluse. *The differentiation of integrals and the almost everywhere convergence of ergodic averages.*

On Hardy-Littlewood-Sobolev Estimates for Degenerate Laplacians

Khalid Baadi

We establish norm inequalities for fractional powers of degenerate Laplacians, where degeneracy is governed by weights in the Muckenhoupt class $A_2(\mathbb{R}^n)$, under additional reverse Hölder conditions. This extends known results on classical Riesz potentials. Our approach relies on size estimates for the associated degenerate heat kernels. This is a joint work with Pascal Auscher.

Kähler-Ricci flow on asymptotically conical gradient Kähler-Ricci expanders—uniqueness and stability

Longteng Chen

Let (M, g, X) be a complete gradient Kähler–Ricci expander with quadratic curvature decay (including all derivatives). Its geometry at infinity is modeled by a unique asymptotic cone, which takes the form of a Kähler cone (C_0, g_0). If there exists a solution to the Kähler–Ricci flow on M that desingularizes this cone, then it necessarily coincides with the self-similar solution determined by the soliton metric g. Furthermore, if one perturbs the soliton metric in a suitable manner, the resulting initial data generates an immortal solution to the Kähler–Ricci flow which, after appropriate rescaling, converges to an asymptotically conical gradient Kähler–Ricci expander.

Distributions, Tanaka's prolongation and Lie algebras of vector fields

Romain Cretier

Since the work of Sophus Lie, the problem of describing finite-dimensionnal Lie algebras of vector fields has appeared in many areas : as a starting point for the symmetry analysis of differential equations, as an important source of information in (pseudo-)Riemannian geometry, or more generally in the geometry of differential systems i.e. distributions in the sense of Chevalley. In the last case, Tanaka provided some theorems of prolongation for graded Lie algebras and G-structures during the second half part of the last century.

In this talk, after some basical settings about non-integrable distributions, I will introduce one Tanaka's theorem of prolongation for transitive graded Lie algebras. I will explain how this theroem provides us a way to translate, in the transitive case, a problem of geometry of distributions in an algebraic problem. To conclude, I will show how we can use this translation to describe the Lie algebras of vector fields preserving the Cartan distribution over the first order jet spaces of functions on the line $J^1(K,K)$, in order to find the results of Lie over the complex numbers ($K = \mathbb{C}$) or the results of Doubrov-Komrakov over the real numbers ($K = \mathbb{R}$).

Lipschitz perturbations that perserve the L^p solvability of the Dirichlet problem

Joseph Feneuil

I will make a review on the know results about the solvability of Dirichlet problem with L^p data, and I will present our latest contribution to the topic, that is that the L^p solvability of the Dirichlet problem in Lipschitz domains is preserved by small Lipschitz perturbations. As a consequence of our theory, we show that for (a strong version of) quasiconvex domains, the Dirichlet problem with L^p data is solvable for all $p \in (1,\infty)$, hence unifying two positive results on the Dirichlet problems (for convex domains and for smooth domains). This is a joint work with Linhan Li and Jinping Zhuge.

The differentiation of integrals and the almost everywhere convergence of ergodic averages

Bastien Lecluse

Let $f \in L^1(\mathbb{R}^n)$ and denote by $B(x,r)$ the ball of radius r centered at x. The Lebesgue differentiation theorem asserts that the average of f over $B(x,r)$ converges to $f(x)$ for almost every $x \in \mathbb{R}^n$ as $r \to 0$. The theory of differentiation of integrals aims to generalize this result by replacing balls with other bounded sets. For instance, can we use rectangles instead of balls? In this talk, I will present some classical results, the main tools involved in this theory, and some open questions.

I will also discuss about the almost everywhere convergence of two-parameter ergodic averages over rectangles in the plane. There are indeed several analogies between these two topics, and I will try to highlight these connections.

The regularity problem for degenerate elliptic operators

Léo Mandô

We study the solutions of the Dirichlet problem on an open set $\Omega \subset \mathbf{R}^n$ for degenerate elliptic operators $L = -\mathrm{div}\,(\mathrm{dist}(\cdot,\partial\Omega)^\alpha \nabla)$, with $-1 < \alpha < 1$. This kind of operators appears naturally when the boundary of the domain has dimension $d < n-1$, for example. We say that the regularity problem associated to L is solvable when there exists a solution whose gradient satisfies a suitable non-tangential bound. Compared to the case of the Laplacian, the definition of this notion must be modified to account for the degeneracy of the operator. I will present partial results toward establishing the solvability of the regularity problem in the case $\Omega = \mathbf{R}^n_+$.