Festum Pi summer school schedule

Tuesday July 9	Wednesday July 10	Thursday July 11	Friday July 12	Saturday July 13
9:00 – 10:45 Villani 11:15-13:00 Santambrogio 14:30-16:00 Mouhot 16:30-18:00 Tertikas	9:00 – 10:45 Alikakos 11:15-13:00 Villani 14:30-16:00 Santambrogio	9:00 – 10:45 Mouhot 11:15-13:00 Alikakos	9:00 – 10:45 Tertikas 11:15-13:00 Santambrogio 14:30-16:00 Villani 16:30-18:00 Alikakos	9:00 – 10:45 Mouhot 11:15-13:00 Tertikas

Festum Pi conference schedule

Monday July 15	Tuesday July 16	Wednesday July 17	Thursday July 18	Friday July 19
9:15-10:15 Rousset 10:30-11:30 Imbert 12:00-13:00 Menegaki 14:30-15:30 Maury	10:30-11:30 Schratz 12:00-13:00 Dafermos 14:30-15:30 Ayi	10:30-11:30 Silvestre 12:00-13:00 Gianniotis	9:15-10:15 Grillakis 10:30-11:30 Tertikas 12:00-13:00 Grandmont 14:30-15:30 Mouhot	10:30-11:30 Villani 12:00-13:00 Alikakos

Program Festum Pi (not complete)

July 2, 2024

1 First week (minicourses)

Nicholas Alikakos
Title: An introduction to the mathematical theory of phase transitions

Clément Mouhot
Title: TBA

Filippo Santambrogio
Title: Optimal transport methods for parabolic diffusion equations : the JKO scheme
Abstract: This mini-course is concerned with those PDEs which have a gradient flow structure in the Wasserstein space W_2 (and/or, in W_p) and can thus be attacked via the so-called Jordan-Kinderlehrer-Otto scheme, a sequence of iterated minimization problems in the space of measures which provide a time-discretization of the solution. The first lecture will introduce the main ideas from gradient flows in the Euclidean space and from optimal transport, explain how to construct an iterative scheme and suggest how to obtain the limit PDE. The second lecture will be focused on the convergence of this scheme to a solution of the PDE and present the main techniques to obtain it, including in the case where the distance W_2 is replaced with W_p, which lets non-linear PDEs of p-Laplace type appear. The last lecture will introduce some tools to prove iterable estimates on the solution of the JKO scheme. We will then show how one can easily recover well-known results for linear diffusion but also new estimates which would be more difficult to guess using "continuous" methods rather than this time-discrete counterpart.

Achilles Tertikas
Title: On Functional inequalities with sharp constants

Cédric Villani
Title: TBA

2 Second week

Monday 15

Frédéric Rousset
Title: TBA

Cyril Imbert
Title: Partial regularity in time for the space-homogeneous Boltzmann equation with very soft potentials

Angeliki Menegaki
Title: TBA

Bertrand Maury
Title: Evolution problems on networks

Tuesday 16

Katharina Schratz
Title: Resonances as a computational tool
Abstract: A large toolbox of numerical schemes for dispersive equations has been established, based on different discretization techniques such as discretizing the variation-of-constants formula (e.g., exponential integrators) or splitting the full equation into a series of simpler subproblems (e.g., splitting methods). In many situations these classical schemes allow a precise and efficient approximation. This, however, drastically changes whenever non-smooth phenomena enter the scene such as for problems at low regularity and high oscillations. Classical schemes fail to capture the oscillatory nature of the solution, and this may lead to severe instabilities and loss of convergence. In this talk I present a new class of resonance based schemes. The key idea in the construction of the new schemes is to tackle and deeply embed the underlying nonlinear structure of resonances into the numerical discretization. As in the continuous case, these terms are central to structure preservation and offer the new schemes strong geometric properties at low regularity.

Mihalis Dafermos
Title: TBA

Nathalie Ayi
Title: Large Population Limit for Interacting Particle Systems on Weighted Graphs
Abstract: When studying interacting particle systems, two distinct categories emerge: indistinguishable systems, where particle identity does not influence system dynamics, and non-exchangeable systems, where particle identity plays a significant role. One way to conceptualize these second systems is to see them as particle systems on weighted graphs. In this talk, we focus on the latter category. Recent developments in graph theory have raised renewed interest in understanding large population limits in these systems. Two main approaches have emerged: graph limits and mean-field limits. While mean-field limits were traditionally introduced for indistinguishable particles, they have been extended to the case of non-exchangeable particles recently. In this presentation, we introduce several models, mainly from the field of opinion dynamics, for which rigorous convergence results as N tends to infinity have been obtained. We also clarify the connection between the graph limit approach and the mean-field limit one. The works discussed draw from several papers, some co-authored with Nastassia Pouradier Duteil and David Poyato.

Wednesday 17

Luis Silvestre
Title: The Landau equation does not blow up.
Abstract: The Landau equation models the evolution of the density of particles when they are assumed to repel each other by Coulomb potentials. It is one of the main equations in plasma physics and kinetic theory. It is a limit case of the Boltzmann equation with very soft potentials. In the space-homogeneous case, we show that the Fisher information is monotone decreasing in time. As a consequence, we deduce that for any initial data the solutions stay smooth and never blow up.

Panagiotis Gianniotis
Title: Splitting maps in Type I Ricci flows
Abstract: Harmonic almost splitting maps are an indispensable tool in the study of the singularity structure of non-collapsed Ricci limit spaces. In fact, by recent work of Cheeger-Jiang-Naber the singular stratification is rectifiable, and almost splitting maps can be used to construct bi-Lipschitz charts of the singular strata. For this, it is crucial to understand how a splitting map may degenerate at small scales, and when it doesn't.

In this talk we will discuss similar issues for a parabolic analogue of almost splitting maps, in the context of the Ricci Flow, and present some new results regarding the existence and small scale behaviour of almost splitting maps in a Ricci flow with Type I curvature bounds. It turns out that, as in the case of harmonic almost splitting maps, an almost splitting map at a given scale remains an almost splitting map even at smaller scales, modulo linear transformations, provided that the flow remains sufficiently selfsimilar. Moreover, we will see that the possible degeneration of these linear transformations is controlled in a certain way by a pointed version of Perelman's W-entropy. We will also discuss how this relates to a conjecture of Perelman on the boundedness of the diameter of a 3d Ricci flow developing a finite time singularity, as we approach the singular time.

Thursday 18

Manoussos Grillakis
Title: On the evolution of interacting Bosons
Abstract: The purpose is to consider a large number of interacting Bosons and study their evolution. It is known that the evolution of the mean field approximation is governed by the Gross Pitaevskii equation (cubic NLS). I will explain how to introduce particle pairs that interact with the mean field. This leads to a better approximation of the exact evolution once the analysis of the coupled system is in place.

Achilles Tertikas
Title: Liouville results for weighted anisotropic elliptic equations

Céline Grandmont
Title: TBA

Friday 19

Nicholas Alikakos
Title: On the triple junction problem without symmetry hypotheses

Cédric Villani
Title: TBA