POLITECNICO MILANO 1863 | DIPARTIMENTO DI MATEMATICA

INdAM Istituto Nazionale di Alta Matematica "Francesco Severi"

Bridging Analysis and Geometry

Dipartimento di Matematica, Politecnico di Milano

December 14th, 2026

Aula Consiglio – 7th floor, Building 14, Via Bonardi 9, 20133 Milano

https://www.mate.polimi.it/events/BAG/

Organizing committee: Giulia Meglioli, Marco Pozzetta, Alberto Roncoroni

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Program

Time	Event
9:55	Opening
10:00 – 10:45	Enric Florit-Simon (ETH Zürich)
10:45 – 11:10	*Coffee break*
11:10 – 11:55	Letizia Branca (Università di Milano)
11:55 – 12:40	Francesca Oronzio (Scuola Superiore Meridionale)
12:40 – 14:40	*Lunch break*
14:40 – 15:25	Alessandro Cucinotta (Universität Wien)
15:25 – 16:10	Dorothea-Enrica von Criegern (Politecnico di Milano)
16:10 – 16:25	*Coffee break*
16:25 – 17:10	Anna Skorobogatova (ETH Zürich)

Titles and Abstracts

Enric Florit-Simon

ETH Zürich

Title: Stable phase transitions and minimal surfaces

Abstract. The Allen-Cahn equation is a fundamental model for phase transitions, originally in alloys between metals. It is governed by a separation parameter; in the limiting case the phases separate completely, and the interface between them may be expected to be of minimal area ("minimal surface").

We will discuss recent progress in the understanding of stable solutions (i.e. those "observable in nature") to the Allen-Cahn equation. The focus will be on the connections with minimal surface theory and two influential conjectures of De Giorgi and Yau.

Letizia Branca

Università di Milano

Title: On the Bach tensor and quadratic curvature functionals

Abstract. The Bach tensor is a fourth-order, symmetric 2-tensor. It has been widely studied on four-dimensional Riemannian manifolds, where it enjoys important conformal properties: indeed, it is closely related to the so-called Weyl functional, whose critical points are Riemannian metrics with vanishing Bach tensor, called Bach-flat metrics. However, very little is known about the relations between the Bach tensor and the topology of the underlying manifold. In this talk, we study the critical points of a quadratic functional depending on the gradient of the Bach tensor on Riemannian four-manifolds, which generalize the Bach-flat condition. We show that, on every closed four-manifold, there exists a weak Bach-parallel metric, i.e. a critical point for this functional with respect to conformal variations. Then we will discuss some properties of the global minima of the functional, providing a new explicit example of a Bach-flat metric. This talk is based on a joint work with D. Dameno.

Francesca Oronzio

Scuola Superiore Meridionale

Title: TBA

Abstract. TBA

Alessandro Cucinotta

Universität Wien

Title: A metric approach to the topology of 3-manifolds with non-negative Ricci curvature

Abstract. A theorem of Gang Liu states that a complete noncompact 3-manifold with nonnegative Ricci curvature either has nonnegative sectional curvature or is homeomorphic to $\mathbb{R}^3$. Liu's proof is based on minimal-surface techniques developed by Schoen, Yau, and others.

I will present an alternative proof of this result, obtained in joint work with Mattia Magnabosco

and Daniele Semola. The proof combines ideas from metric geometry and geometric measure theory, and leads to new topological restrictions for manifolds with nonnegative Ricci curvature in arbitrary dimension.

Dorothea-Enrica von Criegern

Politecnico di Milano

Title: Fractional porous medium equation on manifolds: how geometry shapes smoothing effects

Abstract. From the existence of solutions to their smoothing properties and long-time decay, the geometry of the underlying manifold plays a fundamental role. In this talk, we explore this interplay for the fractional porous medium equation on complete, noncompact Riemannian manifolds with nonnegative Ricci curvature.

Assuming that the manifold is $s-$nonparabolic, we use the corresponding fractional Green function to introduce a natural weighted space of initial data, strictly larger than L^1, and establish existence of nonnegative weak dual solutions. We then establish local smoothing estimates under the assumption of $s-$nonparabolicity. With additional noncollapsing and uniform volume-growth assumptions, these estimates extend globally. Remarkably, even in $\mathbb{R}^n$, data in the Green-weighted space need not generate bounded solutions unless a suitable uniform weighted integrability condition is imposed.

We also discuss the optimality of the resulting short- and long-time estimates. In the range $0 < s < 1/2$, nonnegative Ricci curvature alone guarantees $s-$nonparabolicity, while global smoothing requires only the additional noncollapsing assumption. Interestingly, our approach also extends to $s = 1$, yielding new results even for the classical porous medium equation.

This is joint work with Gabriele Grillo and Dario D. Monticelli.

Anna Skorobogatova

ETH Zürich

Title: $\mathbb{Z}_q$-smooth approximation of mod(q) integral cycles

Abstract. I will discuss a recent joint work with Gianmarco Caldini on the approximation problem for mod(q) cycles in smooth oriented manifolds, where the natural analogue of a smooth approximation turns out to be an approximation by "$\mathbb{Z}_q$-smooth manifolds", which are smooth oriented submanifolds outside of a set of codimension 1 singularities with a very specific topological structure, and were introduced by Morgan & Sullivan in the 70s. I will further discuss examples that demonstrate two important properties of our approximation result: the first is the presence of topological singularities which create the necessity to remove a lower dimensional skeleton, and the second is the fact that such approximation results are in mass and the mod(q) flat topology and cannot generally be upgraded to approximation in support.