Recent Breakthroughs in Singular Stochastic PDEs

(2-6 February 2015)

Department of Mathematics and Applications
University of Milano-Bicocca

Overview

The aim of this school is to present some recent breakthroughs in the theory of non-linear stochastic PDEs, that allow to give a rigorous meaning to some important singular equations for which classical methods fail, due to the irregularity of the noise. Examples include the Kardar-Parisi-Zhang (KPZ) equation in 1d, the equation of stochastic quantization in 3d, the parabolic Anderson model in 2d.

The school is mainly targeted at PhD students and young researchers. There will be two mini-courses by Massimiliano Gubinelli (Université Paris Dauphine) and Lorenzo Zambotti (Université Pierre et Marie Curie), presenting different approaches but discussing analogous examples.

Massimiliano Gubinelli

Paracontrolled distributions and SPDEs

I will explain how ideas from the theory of non-linear waves, namely the paradifferential calculus of Bony, can be used to tackle problems in SPDEs and, more generally, problems involving non-linear operations on distributions. The aim of the mini-course is to develop the ideas and framework necessary to understand and give a meaning to singular (random) PDEs. We will also lay out links with the recent theory of regularity structures by Martin Hairer.

Lorenzo Zambotti

Introduction to the theory of Regularity Structures

In this course we present the main ideas of this recent theory due to Martin Hairer. The motivation is given by a class of singular stochastic PDEs and their renormalization, but the scope of the theory is larger: I plan to emphasize how this formalism can be used to construct a pathwise stochastic integration with respect to multi-parameter (Gaussian) noises, thus generalizing the classical Ito versus Stratonovic integration to a filtration-free setting.

Program

The school starts on Monday 2 February 2015 and finishes on Friday 6 February 2015. Each course consists in 4 lectures of 2 hours each, held in room 3014 (info below), with the following schedule:

|	Mon 2	Tue 3	Wed 4	Thu 5	Fri 6
10:00–12:00	-	Zambotti	Gubinelli	Gubinelli	Zambotti
14:00–16:00	Zambotti	Gubinelli	Gubinelli	Zambotti	-

Venue

The lectures will be given in **room 3014 (3rd floor)** of the **U5 building** (via Roberto Cozzi 55), at the Department of Mathematics and Applications of the University of Milano-Bicocca.

Social Dinner

A "welcome" social dinner will take place on Monday 2 February at 19:00, in the restaurant **Refettorio Simplicitas**, in the very center of Milan (via dell'Orso, 1).

The dinner will feature a full Italian meal (vegetarian options available) and will have a cost of 30 euros/person (including water and wine).

The restaurant can be easily reached from **Piazza Duomo** with a beautiful walk of 10 minutes, through **Galleria Vittorio Emanuele** and **Piazza della Scala**.
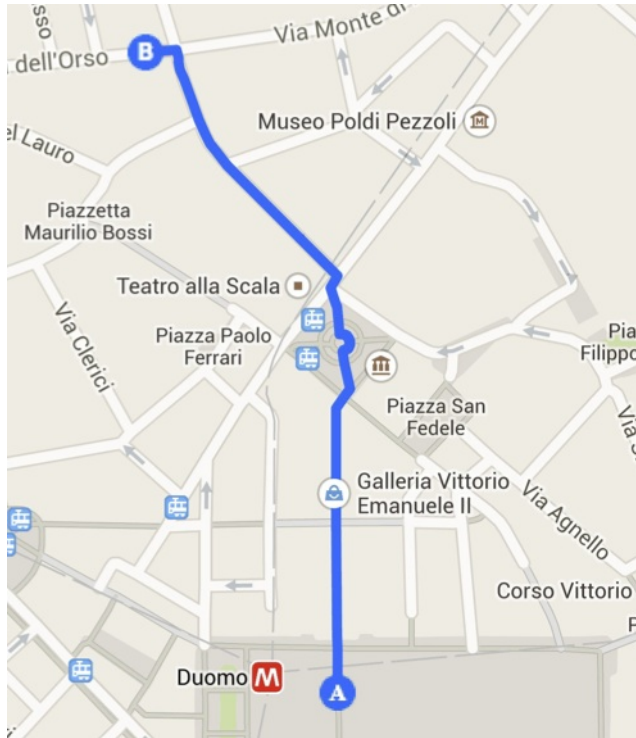
Bicocca District Map

★ Department of Mathematics and Applications

From "Bicocca" M5 Station to Math Dept

📍 "Residenza delle Fontane"

Ⓜ "Bicocca" Station, Metro 5

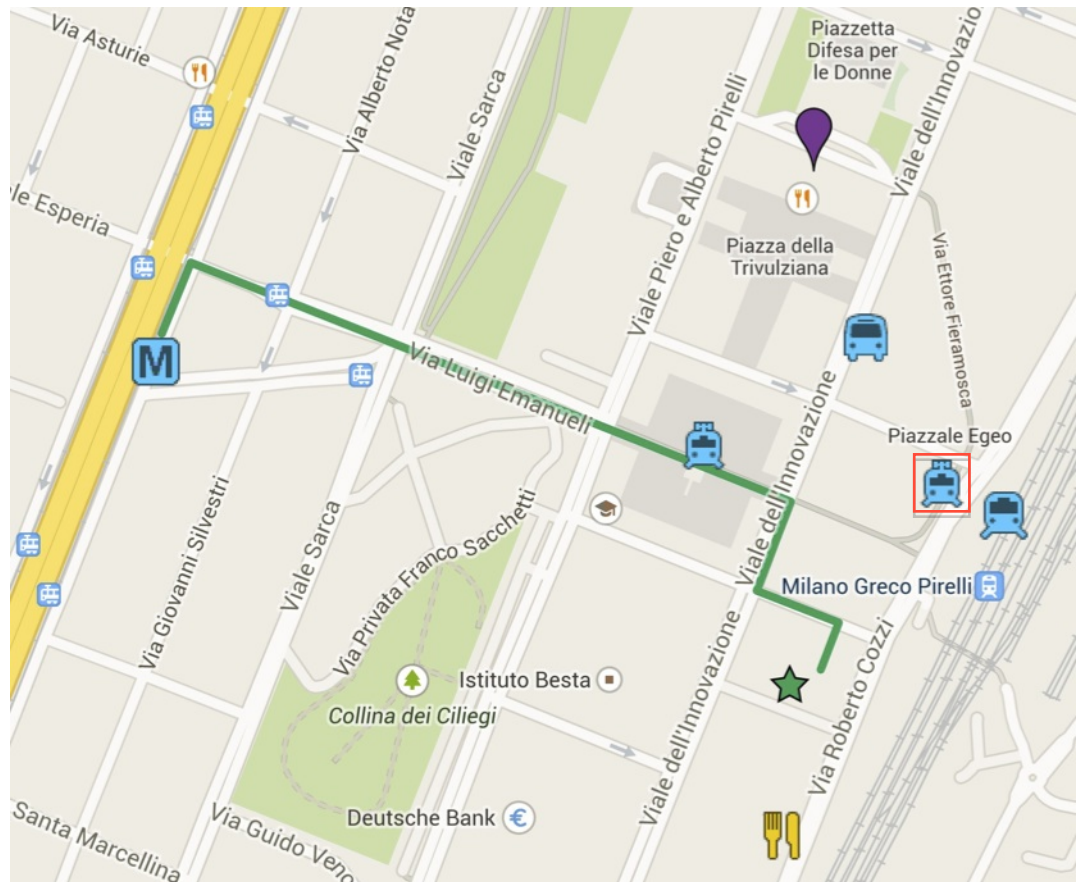🚈 "Università Bicocca Scienza" Station, Tram 7

🚈 "Greco" Station, Tram 7

🚌 "Arcimboldi Ateneo Nuovo" Station, Bus 87

🚌 "Milano Greco Pirelli" Railway Station

🍴 Canteen

Lunch at the Canteen

All participants are welcome to join for lunch at the canteen located in via R. Cozzi 53 (5 minutes walking from the Math Department). A **full meal costs 5.50 euros** and includes:

- Primo (First course): usually pasta, rice or soup;

- Secondo (Second course): usually meat or fish;

- Contorno (Side): vegetables;

- either Fruit or Dessert (self-service from the glass cabinet, before the check-out);

- Drinks (self-service through the dispenser located in the hall);

- Espresso coffee (served at the desk opposite to the check-out, after the meal).

Cold dishes alternatives (ham, cheese, etc.) for Primo and/or Secondo are available in the glass cabinet.

Reduced meal options: without Contorno (**5.10 euros**); without Primo or Secondo (**4.15 euros**).

We will head to the canteen *right after the end of the morning lecture*, so as to reach it before 12:20, in order to avoid crowds.

The canteen personnel is unlikely to speak English (see below for the translated weakly menu). Feel free to ask the organizers and/or Italian participants for more information.

Canteen Menu (2-6 February 2015)

Monday 2

Primo
Pasta al tonno (*Pasta with tuna*)
Minestra d'orzo (*Barley soup*)
Pasta o riso in bianco o al pomodoro (*Pasta or rice, either plain or with tomato sauce*)

Secondo
Tagliata di manzo al pepe verde (*Sliced beef with green pepper*)
Filetto di pesce spada al forno (*Swordfish fillet cooked in the oven*)
Rotolo di frittata e formaggio Valpadana (*Omelette roll with cheese*)

Tuesday 3

Primo
Tortelli di magro burro e salvia (*Vegetables and cheese ravioli (stuffed pasta) with butter and sage*)
Zuppa di ceci (*Cickpea soup*)
Pasta o riso in bianco o al pomodoro (*Pasta or rice, either plain or with tomato sauce*)

Secondo
Scaloppine di lonza alla valdostana (*Loin escalope (pork)*)
Filetto di nasello agli aromi (*Hake fillet (fish)*)
Focaccia al prosciutto / Pizza vegetariana (*Focaccia bread with ham / Vegetarian pizza*)

Wednesday 4

Primo

Gnocchi pasticciati al ragù (*Potato dumplings with Bolognese (meat) sauce*)
Minestrone di carciofi con riso (*Vegetable soup with artichoke and rice*)
Pasta o riso in bianco o al pomodoro (*Pasta or rice, either plain or with tomato sauce*)

Secondo

Goulash all'ungherese (*Hungarian style "Goulash" (stewed veal meat)*)
Pesce spada ai ferri (*Grilled swordfish*)
Brie in crosta (*Brie cheese in a bread crust*)

Thursday 5

Primo

Risotto con salsiccia mantovana (*Risotto (Italian style rice) with sausage*)
Tortellini in brodo (*Ravioli soup*)
Pasta o riso in bianco o al pomodoro (*Pasta or rice, either plain or with tomato sauce*)

Secondo

Cassoeula e polenta tradizionale (*Traditional dish of Northern Italy, made of mixed pork meat and Savoy cabbage, served with "polenta" (cornmeal mush, which can be also taken as a side)*)
Filetto di merluzzo alla livornese (*Codfish fillet*)
Crocchette di ricotta e spinaci (*Croquettes made of ricotta cheese and spinach*)

Friday 6

Primo

Pasta alle vongole (*Pasta with clams (shellfish)*)
Passato di fagioli (*Beans soup*)
Pasta o riso in bianco o al pomodoro (*Pasta or rice, either plain or with tomato sauce*)

Secondo

Salsiccia al forno (*Oven-baked sausage*)
Salmone ai ferri (*Grilled salmon*)
Pizza alle verdure (*Pizza with vegetables*)