one fine day for Chiara

version 14 marzo 2026

09.30 – *opening*

09.45 – 10.14 **Mehmet ERSOY** (Université de Toulon, France)

A Kinetic Heritage for High-Order Discontinuous Galerkin Schemes for the Saint-Venant System

This work extends the Perthame–Simeoni kinetic scheme to a high-order Discontinuous Galerkin framework. While the original construction is naturally optimal in a DG P0 (finite volume) setting, we show that its kinetic structure can be consistently generalized to higher-order reconstructions, preserving its original spirit and structural properties.

10.15 – 10.45 **Paola GOATIN** (INRIA Centre, Université Côte d'Azur, France)

Dissipation of stop-and-go waves in traffic flows using controlled vehicles: a macroscopic approach

We study the boundary stabilization of Generic Second Order Macroscopic traffic models in Lagrangian coordinates. These consist in 2x2 nonlinear hyperbolic systems of balance equations with a relaxation type source term. We provide the existence of weak solutions of the Initial Boundary Value problem for generic relaxation terms. In particular, we do not require the "sub-characteristic" stability condition to hold, so that equilibria are unstable and perturbations may lead to the formation of large oscillations, modeling the appearance and persistence of stop-and-go waves.

Moreover, since the largest eigenvalue of the system is null, the boundaries are characteristic, and the available results on boundary controllability do not apply. Therefore, we perform a detailed analysis of the Wave Front Tracking approximate solutions to show that weak solutions can be steered to the corresponding equilibrium state by prescribing the equilibrium speed at the right boundary. This corresponds to controlling the speed of one vehicle to stabilize the upstream traffic flow.

The result is illustrated through numerical examples.

10.45 – 11.15 *coffee break*

11.15 – 11.45 **Hatem ZAAG** (Université Sorbonne Paris Nord, France)

A cross-shaped blow-up solution for the semilinear heat equation

We consider the semilinear heat equation with a superlinear power nonlinearity in the Sobolev subcritical range. We construct a solution which blows up in finite time only at the origin, with a completely new blow-up profile, which is cross-shaped. Our method is general and extends to the construction of other solutions blowing up only at the origin, with a large variety of blow-up profiles, degenerate or not.

11.45 – 12.15 **Corrado LATTANZIO** (Università degli Studi dell'Aquila, Italia)

Study of fronts for hyperbolic reaction-diffusion models

We investigate existence and stability properties (as a consequence of detailed spectral and linearized analyses) of traveling fronts for hyperbolic variation of the reaction diffusion equations, obtained by the substitution of Fick's diffusion law with a relaxation relation of Cattaneo–Maxwell type. In addition, we present numerical studies in order to determine the propagation speed of the profile, that is the phase-plane algorithm and two PDE-based algorithms, namely the scout and spot algorithm (based on tracking the level curve of some intermediate value of the profile) and LeVeque–Yee formula (given by the average value of the discrete transport velocity).

12.15 – 14.00 *lunch*

14.00 – 14.30 **Thierry GOUDON** (INRIA Centre, Université Côte d'Azur, France)

A well balanced scheme on staggered grids

It was a well established fact that a naive treatment of zeroth oder source terms, like gravity forces, in the numerical simulation of conservation laws leads to instable or unphysical solutions.

After deep remarks from A.-Y Le Roux and J. Greenberg, C. Simeoni proposed in a PhD thesis an elegant way to fix this issue, by setting up a suitable definition of the numerical fluxes which is compatible with the equilibrium solutions of the problems.

We revisit this approach in the framework of staggered discretizations for the Euler equations, where densities and velocities are stored in dual discrete locations.

We derive first and second order versions of a well-balanced scheme, constructed by using the principles of kinetic schemes and hydrostatic reconstructions.

14.30 – 15.00 **Elisa SCANU** (Queen Mary University of London, United Kingdom)

Modelling the evolutionary dynamics of multiple extrachromosomal DNA types in cancer

Cancer cells evolve through complex evolutionary mechanisms, including oncogene amplifications, enabling their escape from normal tissue regulation. In this context, extrachromosomal DNA (ecDNA) elements in cancer cells accelerate evolution, enhance oncogenic transcription, and promote tumour expansion and treatment resistance.

Several studies reveal that cancer cells frequently harbour multiple ecDNA types, whose co-existence facilitates intermolecular gene activation and enhances diversity. The high chromatin accessibility of ecDNA amplifies its sensitivity to epigenetic modifications, further intensifying its impact on tumour adaptability. While some models exist for ecDNA proliferation and inheritance, few have explored the dynamics of multiple ecDNA types while accounting for their phenotypic and genotypic properties.

We present a theoretical framework to analyse evolutionary processes involving multiple ecDNA types, focusing on mechanisms driving their co-occurrence, such as phenotypic shifts and fitness alterations. This model provides insights into ecDNA dynamics and may inform cancer detection and treatment strategies.

15.00 – 15.30 *coffee break*

15.30 – 16.00 **Olivier DELESTRE** (Université Côte d'Azur, France)

Well-balanced modelling of geophysical shallow flows: from rain runoff to turbidity currents

Shallow-water models are widely used to simulate geophysical free-surface flows, ranging from rainfall-runoff on hill-slopes to sediment-laden gravity currents in rivers, reservoirs and oceans. Reliable approximation of these hyperbolic systems requires well-balanced finite volume schemes able to preserve physically relevant steady states.

This talk first reviews recent advances in the well-balanced modelling of rainfall-driven overland flow, focusing on challenging regimes involving thin water depths, wet-dry transitions and steep topography. Numerical validations from analytical tests to laboratory and real catchement applications are briefly presented.

We then discuss the extension of this framework to density-driven turbidity currents described by enriched shallow-water systems with sediment transport and morphodynamic effects. These models introduce additional equilibrium structures and raise new mathematical and numerical challenges. Ongoing work initiated within a rencent student internship will be outlined together with future perspectives.

16.00 – 16.30 **Donato PERA** (Università degli Studi dell'Aquila, Italia)

Numerical simulations of an advection-reaction-diffusion model for forest fire modeling with performance evaluation of GPU and CPU-based high performance computing architectures

Every year in many countries of the world forest fires destroy many hectares of vegetation. These fires events lead the involved states to face: high economic costs for prevention and extinguishing, but also damages to ecosystems, human activities, structures and buildings. In this work according to the modern High Performance Computing (HPC) techniques we performed some numerical simulations and a performance evaluation of a Graphics Processing Unit (GPU) code designed for forest fire simulation. The performed simulations are related to a forest fire mathematical models based on a system of advection-reaction-diffusion equations discretized using a finite differences scheme.

The target of the proposed work is to develop an HPC-GPU code for urgent HPC applications. Indeed fast numerical simulations could be crucial in the fire disaster management especially in early stages. The model has been tested and calibrated for the case of the Fonte Vetica fire (Abruzzo-Italy, august 2017).

Coautori del lavoro Federica Di Michele (INGV), Enrico Stagnini (GSSI) e Bruno Rubino (Univaq).

16.30 – *closure*