CMUP
Centro de **Matemática**
Universidade do Porto

Dynamical Systems Seminar

Date. May 4, 14h30

Place. Room M031

Speaker. Patrícia Gonçalves[1] (CMAT - Universidade do Minho)

Title. From particle systems to partial differential equations

Abstract. In this talk, I will introduce a classical example of Interacting Particle System, namely the Simple Exclusion Process. In this process, particles evolve on the one dimensional torus $\mathbb{T}_n$ according to interacting random walks with an exclusion rule which prevents having more than one particle per site. The dynamics can be informally described as follows. Fix a probability $p(\cdot)$ on $\mathbb{T}_n$. Each particle, independently from the others, waits a mean one exponential time, at the end of which being at the site x jumps to $x \pm 1$ at rate $p(\pm 1)$. If the site is occupied the jump is suppressed in order to respect the exclusion rule. In both cases, the particle waits a new exponential time. I will introduce the notion of hydrodynamic limit, which is a Law of Large Numbers for the empirical measure and I will explain how to derive from the microscopic dynamics between particles, a partial differential equation describing the evolution of the density profile. For example, in the presence of symmetric jumps ($p(1) = p(-1) = 1/2$) we arrive to the heat equation, while for asymmetric jumps ($p(1) \neq p(-1)$) we arrive to the inviscid Burgers equation. I will discuss the dynamical phase transition exhibited by the simple exclusion process in the presence of a finite number of slowed bonds whose jump rate is given by $n^{-\beta}$, with $\beta > 0$. Depending on the range of the parameter β we will cross from the heat equation, to the heat equation with Robin or Neumann boundary conditions.

This is a joint work with T. Franco and A. Neumann, entitled "Hydrodynamical behavior of symmetric exclusion with slow bond" and is accepted for publication in the Annales de l'Institut Henri Poincaré: Probability and Statistics.

Remark. Coffee with the speaker is served after the talk (15h30 - 16h00)

[1]Patrícia Gonçalves is Assistant Researcher at CMAT (Universidade do Minho, Braga) through programme "Ciência 2008". Patrícia graduated in Mathematics at University of Porto in 2002 and she did her Ph.D. at IMPA (Brazil) in 2007, under the supervision of C. Landim. After that she had two Postdoc positions, one of them with Pablo Ferrari and the other one with A. Adrego Pinto as supervisors. She has been working in the Dynamical Systems area, giving a great contribution to the development of this field with several scientific publications. Patrícia's homepage is https://sites.google.com/site/patriciagoncalvesmath/