

# Welcome Home Workshop 2014

NOME: Massimo

COGNOME: Iberti

AFFILIAZIONE: University of Warwick

POSIZIONE: PhD Student

EMAIL: M.Iberti@warwick.ac.uk

LINGUA PER LA CONFERENZA: Italiano

TITOLO: A theory of regularity structure

COAUTORI: Il solo autore é Martin Hairer

## Abstract

Since the work of Wiener and Itô, stochastic partial differential equations (SPDEs) started to gain a major role in our understanding of physical systems, allowing the description of those systems where a noisy term drives the dynamic. Solutions to these equations are typically very irregular, and often defined only in a distributional sense. Often, due to the irregularity of the solutions, equations which arise naturally in physics and statistical mechanics, turn out to be ill defined from a mathematical perspective. There were several attempt to give a meaning to the above equations via the definition of integration of irregular object with the theory of rough paths, introduced by Terry Lyons and developed by Gubinelli. After the work by Da Prato, Debussche, Lyons, among the others, Martin Hairer first gave a meaning to the solution of the Kadar-Parisi-Zhang (KPZ) equation, suitably renormalised. Generalising his work on the previous equation, he developed a general theory of regularity structure. The paradigm of the theory consists in defining a consistent algebraic structure, which is chosen ad-hoc for the problem, and suitable operations on it, that are "well behaving" with respect to regularity of a suitable class of functions. Then the theory provides tools to solve the problem in the abstract setting, and to reconstruct a proper solution for a "renormalized version" of original problem. That is in fact the key tool of the theory.

In the talk, the Fields-Medal-winning theory of regularity structure by Martin Hairer is presented. This new approach unified several previous works allowing to give a meaning to solutions of equation arising looking at macroscopic behaviour of statistical mechanical model near criticality, for example dynamical  $\phi_3^4$  model arising in the stochastic quantisation of Euclidean quantum field theory or the KPZ equation.