Title

Reaction-diffusion equations for modelling of transport in porous media

Proposed dates and place

IHP, November 2011

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1.1 Proposal

1.2 Introduction and motivation

The modeling of matter is encountered in numerous fields in fundamental and applied sciences. In SILICO methods (in computer) used to solve these problems are common to many disciplines, like for example physicists, chemists, applied mathematicians. Most of the time the physical information is used to set partial differential systems of equations which is solved by many different kind of algorithms. It yields the question of the efficiency of the methods, of primary interest for applied sciences, together with the fundamental question of the accuracy. This is related to micro-macro modeling which receive increasing interest among the scientific community. The coupling of matter with electrostatic field is another subject of interest with applications to many different problems, from transport of charged particles to plasma physics.

1.3 State of the art

All teams involved in the proposal (PECAS-UPMC, LJLL-UPMC, CERMICS-UPMC) have developed advanced algorithms and convenient numerical models for computing approximate solution (in computer) of various problems. The expertise in the Pecsa team concerns for example transport in colloids in porous media: the role of electrostatic interaction is proeminous. Some physical experiments help to select the most relevent models and parameters. The so-called Boltzmann-Poisson model is relevant in this context. Families of reaction-diffusion equations are well known to be quite difficult to solve, depending on the physical and mathematical structure. It raises fundamental problems for the design of optimized algorithms in terms for example of compatibility with the architecture of modern computers. The LJLL-UPMC group has a strong expertise in numerical analysis and the development of optimized approximation procedures and methods for for various problems coming from applied sciences and industry. The CERMICS group is deeply involved in the development of advanced mathematical models for the modelling of matter in any situations.

1.4 Objectives

Our goal is to gather scientists, applied mathematics, physicists and chemico-physicists from these teams and from other groups, in order to exchange ideas and problems and to foster possible future collaborations.

1.5 Format of the program

We think of 4 presentations (30' each) in the morning, followed by a 10' presentation of the computing UPMC institute (Equipex Meso). The afternoon will be composed of 4 30' presentations, followed by a 1h round table. We will propose to Pierre Turq to animate the discussion.

1.6 Participant List

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Ayman Moussa (LJLL-UPMC)

We will propose to Pascal Frey to present the computing UPMC institute (Equipex Meso). We will propose to various researchers to join us in order to reach around 20 participants.

2. Financial Support

We ask for a 1000 € funding (lunch plus organization).