

Laboratoire de mathématiques Jean Leray
Unité mixte de recherche 6629

COLLOQUIUM

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Amphi Pasteur

PIERRE DEGOND
(Imperial College London)

" Mathematical challenges in collective dynamics and self-organization "

Most living or social systems consist of a large number of agents interacting through elementary rules involving only neighbouring agents. In spite of their simplicity, these interactions drive the system towards a self-organized coherent collective behavior. The emergence of collective dynamics poses many mathematical challenges which will be outlined in this talk. We will use the example of the Vicsek model (in which self-propelled particles interact through local alignment) to show how the loss of conservations and the analysis of phase transitions can be apprehended. Examples of applications, notably to sperm-cell collective dynamics will be presented.