

In the recent years a fruitful interaction has taken place between probability, functional inequalities and nonlinear partial differential equations (PDEs). Among others, there have been advances in entropy/entropy production inequalities for nonlinear aggregation-diffusion equations and transport inequalities and their links to the probability distribution of Fokker-Planck models. Some examples of current interest are the applications of variants of the Hardy-Littlewood-Sobolev inequality to understand Keller-Segel-type models and of Doeblin/Harris methods in integral kinetic equations. On the other hand, the analysis of stochastic interacting particle systems, stochastic PDEs and related relevant questions such as mean-field limits and phase transitions is booming; in particular due to the important applications in life-sciences. This summer school proposes five courses which give an advanced introduction to these topics and their applications in life sciences models, and six talks that present current related research problems.

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#### INFORMACIÓN GENERAL

→ **Hasta el 15 de junio de 2018**

**Santander**  
Campus de Las Llamas  
Avda. de los Castros, 42  
39005 Santander  
Tel. 942 29 87 00 / 942 29 87 10  
informacion@sa.uimp.es

**Madrid**  
C/ Isaac Peral, 23  
28040 Madrid  
Tel. 91 592 06 31 / 91 592 06 33  
alumnos@uimp.es

**Horario**  
de 9.00 a 14.00 h  
de 16.00 a 18.00 h (excepto viernes)

#### PLAZOS

→ **Plazo de solicitud de becas**  
Hasta el día 28 de mayo, para los cursos que comiencen antes del 6 de julio de 2018

Hasta el día 15 de junio, para los cursos que comiencen a partir del día 9 de julio de 2018



→ **A partir del 18 de junio de 2018**

**Santander**  
Palacio de la Magdalena  
39005 Santander  
Tel. 942 29 88 00 / 942 29 88 10

**Horario**  
de 9.00 a 14.00 h  
de 16.00 a 18.00 h (excepto viernes)

→ **Apertura de matrícula**  
Desde el 8 de mayo de 2018  
(Plazas limitadas)

→ Código 63U5 | Tarifa: C | ECTS: 1

Portada: basada en el original de Hugo Fontela para la UIMP 2018

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**UIMP** Universidad Internacional  
Menéndez Pelayo

**Santander 2018**

**XIX School of Mathematics «Lluís Santaló»**

Del 13 al 17 de agosto



**Interactions between PDE and probability**

José Antonio Carrillo de la Plata  
José Alfredo Cañizo Rincón

Organizado en colaboración con

Real Sociedad  
Matemática Española

[www.uimp.es](http://www.uimp.es)

041-18-002-0

## XIX SCHOOL OF MATHEMATICS «LLUIS SANTALÓ»

## Interactions between PDE and probability

## Dirección

José Antonio Carrillo de la Plata

Professor

Department of Mathematics

Imperial College London

José Alfredo Cañizo Rincón

Investigador Ramón y Cajal

Departamento de Matemática Aplicada

Universidad de Granada

## Del 13 al 17 de agosto de 2018

## Lunes 13

09.00 h | The single neuron: slow-fast dynamics

Benoît Perthame

Professor

Laboratoire Jacques-Louis Lions,

Université Pierre et Marie curie

10.00 h | The Integrate-and-Fire model, role of noise

Benoît Perthame

11.30 h | Self-similarity in Smoluchowski's coagulation equation Barbara Niethammer

Professor

Institute for Applied Mathematics,

Universität Bonn

12.30 h | Long time behaviour and phase transitions for the McKean- Vlasov equation

Grigorios Pavliotis

Professor

Department of Mathematics,

Imperial College London

15.00 h | Discrete variational problems in random settings and their continuum limits (I)

Dejan Slepcev

Professor

Department of Mathematical Sciences,

Carnegie Mellon University

16.00 h | Discrete variational problems in random settings and their continuum limits (II)

Dejan Slepcev

## Martes 14

09.00 h | Discrete variational problems in random settings and their continuum limits (III)

Dejan Slepcev

10.00 h | Discrete variational problems in random settings and their continuum limits (IV)

Dejan Slepcev

11.30 h | The BPHZ theorem for stochastic PDEs (I)

Martin Hairer

Professor

Department of Mathematics

Imperial College London

12.30 h | The BPHZ theorem for stochastic PDEs (II)

Martin Hairer

15.00 h | Analysis of the Integrate &amp; Fire model

Benoît Perthame

16.00 h | Time elapsed models

Benoît Perthame

17.00 h | Poster sessions

Matteo Bonforte

Professor

Departamento de Matemáticas

Universidas Autónoma de Madrid

Martin Hairer

Xue-Mei Li

Professor

Department of Mathematics

Imperial College london

Barbara Niethammer

Juan Luis Vázquez

Profesor Emérito

Departamento de Matemáticas

Universidad Autónoma de Madrid

## Miércoles 15

09.00 h | The BPHZ theorem for stochastic PDEs (III)

Martin Hairer

10.00 h | The BPHZ theorem for stochastic PDEs (IV)

Martin Hairer

11.30 h | Hessian estimates for Schrodinger equations

Xue-Mei Li

12.30 h | Nonlinear and Nonlocal Degenerate Diffusions on Bounded Domains

Matteo Bonforte

## Jueves 16

09.00 h | Partial differential equations and interacting stochastic many-particle models for self-attraction and self-organization in biology

Angela Stevens

Professor

Institut für Numerische und Angewandte Mathematik

Fachbereich für Mathematik und Informatik

Universität Münster

10.00 h | Moderately interacting stochastic many particle systems

Angela Stevens

11.30 h | Open problems at the interface between PDEs &amp; probability

Matteo Bonforte

Xue-Mei Li

Martin Hairer

Grigorios Pavliotis

Benoît Perthame

Dejan Slepcev

Juan Luis Vázquez

Moderación

José Alfredo Cañizo Rincón

15.00 h | The Harris-Meyn-Tweedie theorem in PDEs and kinetic theory

José Alfredo Cañizo Rincón

16.00 h | Dislocations as finite size singularities and rigidity estimates

Stephan Luckhaus

Professor

Institute of Mathematics

Universität Leipzig

## Viernes 17

09.00 h | A PDE-ODE system and its connection to reinforced random walks

Angela Stevens

10.00 h | A hydrodynamic limit for chemotaxis in heterogeneous environments

Angela Stevens

11.30 h | Aggregation-diffusion equations: stationary states, gradient flows, radial symmetry and metastability

José Antonio Carrillo de la Plata

12.30 h | Degenerate Fractional Diffusion Equations. A review

Juan Luis Vázquez