![Queen Mary University of London]

CoSyDy meeting on
Long-range correlations in space and time

Organisers: Rosemary J. Harris and Hugo Touchette
School of Mathematical Sciences, Queen Mary, University of London

Friday, 27th May 2011

Description

Much effort has focused recently on developing models of stochastic systems that are non-Markovian or show long-range correlations in space or time, or both. The need for such models has come from many different fields, ranging from mathematical finance to biophysics, and from engineering to statistical mechanics.

This workshop will bring together a number of mathematicians and engineers interested in stochastic processes having long-range correlations, with a view to share ideas as to how we can define such correlations mathematically, as well as to how we can devise stochastic processes that go beyond the Markov model.

The meeting is part of the CoSyDy series, a London Mathematical Society Scheme 3 network bringing together UK mathematicians investigating Complex Systems Dynamics.

Schedule

12:15–13:05	Buffet lunch and welcome
13:10–13:55	Thierry Bodineau, *Département de Mathématiques et Applications, ENS, Paris* *Long range correlations in non-equilibrium systems*
14:00–14:25	Robert Jack, *Department of Physics, University of Bath* *Large deviations, glass transitions, and long-ranged correlations*
14:30–14:55	Robert Concannon, *School of Physics & Astronomy, University of Edinburgh* *A non-Markovian Asymmetric Simple Exclusion Process*
15:00–15:25	Tea and coffee
15:30–16:15	Sergei Fedotov, *School of Mathematics, The University of Manchester* *Long-memory effects in anomalous diffusion with reactions*
16:20–16:45	Raul Mondragon, *Department of Electronic Engineering, Queen Mary, University of London* *Long-range correlations in queues*
16:50–	Drinks and discussion

Information and registration

The meeting will be held in Room 103 of the Mathematics Building at Queen Mary, University of London.

Directions can be found at `http://www.maths.qmul.ac.uk/about/location.shtml` and the nearest underground stations are Stepney Green (District line) and Mile End (Central line)

Attendance at this workshop is free but, for catering purposes, please register your attendance via email to `h.touchette@qmul.ac.uk` or `rosemary.harris@qmul.ac.uk` by 20th May.

Long range correlations in non-equilibrium systems

Thierry Bodineau

Département de Mathématiques et Applications, ENS, Paris

A generic property of systems maintained out of equilibrium by reservoirs is the occurence of long range correlations. In this talk, we will first review the large deviations of the steady state density and relate it to the long range correlations. We will then focus on the non-equilibrium correlations when a system approaches a phase transition.

Large deviations, glass transitions, and long-ranged correlations

Robert Jack

Department of Physics, University of Bath

At glass transitions, systems acquire long-ranged correlations in time, and it is increasingly clear that these are accompanied by growing spatial correlations. By applying dynamical fields that bias the system towards inactive states, we show how the relevant length and time scales may diverge even in systems that lack equilibrium phase transitions. We discuss the significance of these results for theories of the glass transition.

A non-Markovian Asymmetric Simple Exclusion Process

Robert Concannon

School of Physics & Astronomy, University of Edinburgh

In this presentation we explore a novel modification to the Asymmetric Simple Exclusion Process (ASEP) on a 1D ring. We made the ASEP non-Markovian by drawing the time of the next move of each motile element from a power law distribution. This has interesting consequences for the flow of particles around the ring as, for a correctly chosen decay parameter, traffic jams spontaneously form and break apart. This behaviour is qualitatively different from condensation effects seen in other modifications of the ASEP. We find that traffic jams containing all motile elements exist for a finite fraction of the time, the fraction depending on the exponent of the power-law waiting time distribution and the number of the elements. We call such jams full clumps. We investigate the conditions under which we expect full clumps to occur. Using basic arguments and extreme value theory we can explain some of the features of the distributions of the clump formation times, clump lifetime and the time between clumps that we see in simulations.

Long-memory effects in anomalous diffusion with reactions

Sergei Fedotov

School of Mathematics, The University of Manchester

The main aim of the talk is to discuss how to incorporate the nonlinear kinetic term into non-Markovian transport equations describing long-memory effects in anomalous diffusion. We will also discuss a nonlinear random walk model which is suitable for the analysis of both chemotaxis and anomalous subdiffusive transport. We derive the master equations for the population density for the case when the transition rate for a random walk depends on residence time, chemotactic substance, and population density.

Long-range correlations in queues

Raul Mondragon

Department of Electronic Engineering, Queen Mary, University of London

We present an overview on the analysis of self-similar traffic models and queue performance using chaotic maps. Data packet traffic can be described by an ON/OFF (active/silent) model where ON means traffic production. If the ON periods are described by a heavy-tailed distribution then the traffic trace is long-range dependent. If this traffic is fed to a queue, the decay of the queue length probability is also heavy-tailed. We observed that it is possible to change the queue length probability from heavy-tailed to exponential without destroying the long-range dependence property of the traffic.