LONDON MATHEMATICAL SOCIETY
EST. 1865

4TH OPSFOTA/ SEMINAR

16th January, 10am-5.30pm
University of Kent, Canterbury

4th meeting of the Research Group on Orthogonal Polynomials, Special Functions and Operator Theory and Applications, supported by a London Mathematical Society Joint Research Groups grant.

Speakers:

Marta Betcke (University College London), Niels Bonneux (KU Leuven, Belgium), Rod Halburd (University College London), Andy Hone (University of Kent) and Nick Simm (University of Sussex).

Further information
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https://blogs.kent.ac.uk/aloureiro/1st-opsfota-seminar/

University of Kent

4th OPSFOTA

University of Kent

4th meeting of the Research Group on

Orthogonal Polynomials, Special Functions and Operator Theory and Applications

11.00 - 11.50	Nick **Simm** (University of Sussex) Title: *Critical behaviour in non-Hermitian random matrices and Painlevé transcendents*	Sibson SR4
12.00 - 13.00	Lunch	Sibson cafe
13.00 - 13.50	Marta **Betcke** (University College London) Title: *Photoacoustic tomography with incomplete data: subsampled and dynamic problems*	Sibson SR3
14.00 - 14.50	Rod **Halburd** (University of Leuven, Belgium) Title: *Special functions and integrable equations in characteristic* p	Sibson SR3
15.00 - 15.30	Coffee/Tea break	Sibson Staff Room
15.30 - 16.20	Niels **Bonneux** (KU Leuven) Title: *Wronskian Appell polynomials*	Sibson SR3
16.30 - 17.20	Andy **Hone** (University of Kent) Title: *Chebyshev polynomials, Lehmer numbers, and huge primes*	Sibson SR3
19.00-	Dinner	

This meeting is supported by

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Book of abstracts

Marta Betcke (University College London, UK)

Title. Photoacoustic tomography with incomplete data: subsampled and dynamic problems

Abstract. In photoacoustic imaging, as in many high resolution modalities, the major bottle neck is the acquisition time of finely spatially sampled data. In particular for imaging of dynamical processes, this results in incomplete data. In this talk I am going to review the journey towards dynamic photoacoustic imaging we embarked on in our group at UCL. I will consider fast numerical models for wave propagation for the implementation of the forward and the adjoint operators. I will describe different approaches to reconstruction from compressed or subsampled data for acceleration of a static image reconstruction and finally I will discuss fully dynamic image reconstruction using spatio-temporal regularisation within the variational framework.

Joint work with Simon Arridge, Andreas Hauptmann, Felix Lucka, Nargiza Djurabekova, Bolin Pan, Kiko Rullan from Inverse Problems group and UCL Paul Beard, Ben Cox, Nam Huynh, Bradley Treeby, Edward Zhang from Photoacoustic Imaging Group at UCL

Niels Bonneux (KU Leuven, Belgium)

Title. Wronskian Appell polynomials

Abstract. An Appell sequence $(p_n)_{n=0}^{\infty}$ consists of monic polynomials of increasing degree, such that the derivative of each polynomial is a multiple of the preceding polynomial: $p_n' = np_{n-1}$. We extend the notion of such sequences to Wronskian Appell polynomials $(p_\lambda)_{\lambda\in\mathbb{Y}}$, that are labeled by integer partitions instead of positive integers. The main modification of the derivative property lies in the fact that a partition might have multiple predecessors. The polynomials obtained in this way appear in the rational solutions of Painlevé equations, which is the main motivation behind these objects of study.

University of Kent

Rod Halburd (University College London, UK)

Title. **Special functions and integrable equations in characteristic p**

Abstract. Natural analogues of differential and difference equations with solutions defined on functions fields over finite fields will be discussed. Analogues in this setting of important special functions such as the exponential, gamma and hypergeometric functions have been discovered by Carlitz, Goss, Thakur and others. We will discuss integrable analogues of certain differential and difference equations in this context and the role played by singularity analysis.

Andy Hone (University of Kent, UK)

Title. **Chebyshev polynomials, Lehmer numbers, and huge primes**

Abstract. The Chebyshev polynomials of the 1st and 2nd kinds are very well known in the context of numerical analysis and in the theory of orthogonal polynomials. Less well known are the Chebyshev polynomials of the 3rd and 4th kinds - also known as "airfoil polynomials" - which appear in the analysis of fluid flow over an aerofoil. We consider the appearance of prime numbers in a family of linear recurrence sequences, labelled by a positive integer n. The terms of each sequence correspond to a particular type of number studied by Lehmer, or (viewed as polynomials in n) the Chebyshev polynomials of the 4th kind. It turns out that when n is given by a Chebyshev polynomial of the 1st kind evaluated at a suitable integer, either the sequence contains a single prime, or no term is prime. For all other values of n, it is conjectured that the sequence contains infinitely many primes, whose distribution has analogous properties to the distribution of Mersenne primes among the Mersenne numbers. However, most of these (probable) primes are so huge that numerical attempts to measure their distribution test the limits of standard computer algebra packages such as Maple or Mathematica.

Nick Simm (University of Sussex, UK)

Title. **Critical behaviour in non-Hermitian random matrices and Painlevé transcendents**

Abstract. I will discuss some examples of critical behaviour in ensembles of random matrices with complex spectrum. This is joint work with Alfredo Deaño (Kent).