PhD Training in the Cambridge Centre for Analysis

Professor Arieh Iserles  cca@maths.cam.ac.uk
Key Dates

• Deadline for Applications: 15\textsuperscript{th} January 2012

Further information and how to apply:

http://www.maths.cam.ac.uk/postgrad/cca/prospective
What is the scientific scope of the CCA?

We develop a broad skills base in Analysis – with core first year courses:

- Analysis of partial differential equations
- Stochastic analysis
- Computational analysis

Also an individual programme of further courses from the Cambridge Master of Mathematics course

Also…
CCA Mini-projects

Each student will undertake two mini-projects: one in Michaelmas and the second in Lent Term. The mini-projects must be in two very different and distinct areas of analysis.

Mini-project 1

The first mini-project is modest in scope: commencing from a thorough literature review in a well-defined subject, and making a critical appraisal of the state of the art. The project may also involve some original research work under the guidance of the supervisor.
Mini-project 2

Second mini-projects are more ambitious in their scope.

As well as understanding the relevant literature, the student will engage in original research and be encouraged to include elements drawing on modern techniques of theory and computation.

The assessment of this mini-project is in two parts: a conference-style presentation to the full CCA (in late May) and a substantial final written report (approximately 30 pages in the style of a journal paper) to be submitted in mid-June. Feedback to the student on the second mini-project is given in late June.

*Often one of the mini-projects will eventually evolve into a fully-fledged PhD dissertation in years 2–4.*
• Computation of Frechet derivative matrices for reservoir modelling
• Linear stability and instability of plasmas
• Coalescing random walks
• Vortex generation in exciton--polatiton condensates
• Transient perturbation growth in stratified shear flows
• Efficient quadrature for isogeometric analysis
• Multiscale coupling of continuum and particle models
• Carlemann estimates, unique continuation and the 'no-hair' theorems for black holes -- revisited
• Generalised harmonic maps associated to nonlocal Skyrme energy
• Dispersionless limit of soliton equations
• Adaptive gridding for numerical modelling of wave propagation
• The generalized D-to-N map for evolution equations on the half-line and transparent boundary conditions
• Initial-boundary value problems for a Burgers type equation
• Enhanced diffusive flux to a patchy sphere in flow
• Entire solutions of the minimal surface equation
• Continuum percolation
• Generalized sampling and infinite-dimensional compressed sensing with wavelets in medical imaging
• Optimization of compressed sensing by image transformation
• Efficient estimation of functionals of probability densities with application to climate sensitivity analysis
• Investigating stochasticity in a multicellular stem cell regulatory model
• Spectral analysis of Fox--Li operator
• Stability of asymptotic solvers of highly oscillatory ODEs
• Dynamic stochastic games
• Elliptic and Fredholm theory on manifolds with 'boundary at infinity'
• Decentralized control of large scale networks
• Markov decision processes and biological networks
• A low-order model for the fluid-dynamical sewing machine
• An integro-differential equation in elastohydrodynamics
• Concentration-compactness in PDEs and orbital stability of galaxy configurations
• Heat flow in a rough medium and noisy optimal transport
• Channel equalizers
• Gradient-based optimization method
• Internal DLA via conformal maps
• Wave singularities in ideal fluids
• Modelling of electrohydrodynamic phenomena in aircraft fuel tanks
• Migration resonances and instabilities in exoplanetary systems
• Pseudospectra and the stability of aerodynamic flows
• Wave scattering by a quarter plane and the spectrum of the Laplace-Beltrami operator
• Bifurcation and pattern formation in convection near a melting boundary
• Mean-field Markov chains
• The two-sided exit problem for Levy processes
• Shape-constrained density estimation under model misspecification
• Video processing - a non-smooth optical flow approach
• Splitting methods for fourth-order image inpainting
• Explicit form of Zolotarev polynomials
• Landau--Kolmogorov inequalities
• Wave propagation in probabilistic media
• Adaptive Markov chain Monte Carlo
• Decentralized hypothesis testing in networks under limited memory and communication
PhD study in Years Two to Four

• Geometric analysis
• PDEs of mathematical physics
• Stochastic analysis
• Mathematical statistics
• Computational analysis
• Applied PDEs
• Mathematics of information
• Applications of analysis in engineering, science, industry and medicine

Also…
PhD study in Years Two to Four

- Mini-courses and seminars by international experts, eg:
  
  *Professor Andrew Blake, Microsoft*
  *Professor E.B. Davies, King’s College*
  *Dr Tanya Morton, Mathworks*
  *Professor John Ball, University of Oxford*

- Annual workshop with MASDOC
- CCA graduate student seminar
- Training in professional skills
- Seminars and study groups on Industrial mathematics
- Support for conference and workshop participation outside Cambridge
Who’s who? CCA Steering Committee

Sir John Ball FRS
University of Oxford

Professor Andrew Blake FRS
Microsoft Research

Professor Peter Haynes
Head of DAMTP

Professor Martin Hyland
Head of DPMMS

Dr Bruce Smith
Smith Institute for Industrial Mathematics

Professor Cédric Villani
École Normale Supérieure de Lyon
## Who’s who? CCA staff

<table>
<thead>
<tr>
<th>Dr Nathanael Berestycki</th>
<th>Dr Jonathan Ben-Artzi</th>
<th>Dr Colm Caulfield</th>
<th>Professor Mihalis Dafermos</th>
<th>Dr Sophia Demoulini</th>
<th>Professor Thanasis Fokas</th>
<th>Professor Geoffrey Grimmett</th>
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<tr>
<td>Professor Arieh Iserles</td>
<td>Professor Frank Kelly</td>
<td>Professor Peter Markowich</td>
<td>Dr Clément Mouhot</td>
<td>Dr Richard Nickl</td>
<td>Professor James Norris</td>
<td>Professor Nigel Peake</td>
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<td>Dr Richard Samworth</td>
<td>Dr Carola Schoenlieb</td>
<td>Dr Alexei Shadrin</td>
<td>Dr David Stuart</td>
<td>Dr Neshan Wickramasekera</td>
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### Who’s who?

#### CCA Cohort 2010

<table>
<thead>
<tr>
<th>Student</th>
<th>Name</th>
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<tr>
<td>Marc Briant</td>
<td>F013 mjb249</td>
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<tr>
<td>Damon Civin</td>
<td>F007 dc509</td>
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<tr>
<td>Spencer Hughes</td>
<td>F117 sth24</td>
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<tr>
<td>Anastasia Kisil</td>
<td>F013 ak528</td>
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<tr>
<td>Bernd Kuhlenschmidt</td>
<td>F114 bk303</td>
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<tr>
<td>Sara Merino</td>
<td>F007 sm851</td>
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<td>Ed Mottram</td>
<td>F007 ejm66</td>
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<td>Kostas Papafitsoros</td>
<td>F117 kp366</td>
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<td>Florian Pinsker</td>
<td>F114 fp278</td>
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<td>Kolyan Ray</td>
<td>F013 kmr50</td>
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<tr>
<td>Bali Sengul</td>
<td>F117 bs431</td>
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#### CCA Cohort 2011

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<thead>
<tr>
<th>Name</th>
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<tr>
<td>Luca Calatroni</td>
<td>F002</td>
<td>kc524</td>
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<td>Alberto Coca</td>
<td>F005</td>
<td>ac776</td>
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<td>Kevin Crooks</td>
<td>F004</td>
<td>kmc47</td>
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<tr>
<td>Eoin Devane</td>
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<td>Milana Gataric</td>
<td>F003</td>
<td>mg617</td>
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<td>Adam Jones</td>
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<td>Natalia Kudryashova</td>
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<td>Clarice Poon</td>
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<td>Gil Ramos</td>
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<td>Martin Taylor</td>
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<tr>
<td>Lukas Vermach</td>
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<td>Zipeng Wang</td>
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<td>zw255</td>
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Centre for Doctoral Training in Mathematical Analysis
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PhD Training in Mathematical Analysis
including: partial differential equations, harmonic analysis, stochastic analysis, computational analysis, mathematical modelling