Geometry, Stochastics & Dynamics

Celebrating 20 years of UK-Japan Winter Schools

Monday Morning

Kenji Fukaya (Stony-Brook). 11:00 am -11:50 am
TBA

Monday Afternoon

- Martin Hairer (ICL) 2:00-2:50

  TBA

- Chris Budd (Bristol)

  The mathematics of climate change

  Climate change is important, controversial, and the subject of huge debate. Much of our understanding of the future climate comes from the use of complex climate models based on mathematical and physical ideas.

  In this talk, I will describe how these models work and the assumptions that go into them. I will discuss how reliable our predictions of climate change are, and show how mathematicians can give us insights into both past and future.

- Yoshiaki Maeda (Tohoku/Keio) 4:20-5:10

  Geometry of Loop space and the fundamental group of contact manifolds

  "We study the diffeomorphism and isometry groups of manifolds Mp, p 2 Z, which are circle bundles over a closed 4n-dimensional integral symplectic manifold. Equivalently, Mp is a compact (4n+1)-dimensional contact manifold with closed Reeb orbits. We use Wodzicki-Chern-Simons forms to prove that 1(Diff(Mp) and 1(Isom(Mp)) are innite for $jpj \geq 0$: For the Kodaira-Thurston manifold, we explicitly compute that this result holds for all p. We also give the rest examples of nonvanishing Wodzicki-Pontryagin forms."

Tuesday Morning

- Darryl Holm (ICL) 9:30-10:20

  A Stochastic Climate Change Model

  A generic approach to stochastic climate modelling is developed for the example of an idealized Atmosphere-Ocean model that rests upon Hasselmann's paradigm for stochastic climate models. Namely, stochasticity is incorporated into the fast moving atmospheric component of an idealised coupled model by means of stochastic Lie transport, while the slow moving ocean model remains deterministic. This is joint work with D Crisan and P Korn. A remarkable property of the model is that the dynamics of its higher moments are governed by deterministic equations obtained by replacing the drift velocity of the stochastic Lie transport vector field by its expected value.

- Takashi Sakajo (kyoto) 10:50-11:40

  Topological flow data analysis - theory and applications

  We construct a mathematical theory classifying topological structures of orbits generated by structurally stable Hamiltonian vector fields, which is a model of two-dimensional incompressible fluid flows. Based on the classification theory, we can show that structurally stable Hamiltonian flows are in one-to-one correspondence with Reeb graphs, and their symbolic expressions, named COT representations. By using this theory, we then develop a new way of topological data analysis, which we call Topological Flow Data Analysis (TFDA). In the present talk, after the classification theory is presented, I will talk about the recent applications of TFDA to geophysical data in atmospheric science and oceanography. The talk is based on the joint works with T. Yokoyama (Gigu U), T. Uda (Tohoku U), M. Inatsu (Hokkaido U), S. Oishi (RIKEN) and K. Koga (Kyoto U).

Tuesday Afternoon

- Graeme Segal (Oxford). 2:00-2:50

  TBA

- Hiroshi Iritani (Tokyo) 3:20-4:10

  TBA

- Yota Samoto (Waseda) (4:20-4:50)

  TBA

Wed Morning

- Peter Topping (Warwick) 9:30-10:20

  TBA

- Jonathan Fraser (St Andrews)10:50-11:20.

  Dimension interpolation in conformal dynamics

  'Dimension interpolation' is the idea that by viewing two distinct notions of fractal dimension (e.g. Hausdorff and box-counting dimension) as extremes in a carefully defined 'continua of dimensions', one may gain a more nuanced understanding of the fractal objects at hand. I will review recent developments in this area in the context of conformal dynamics.

- Ben Lambert (11:30-12:00)

  TBA

Thursday Morning

- Takashi Kumagai (Waseda) 9:30-10:20

  Anomalous diffusions and time fractional differential equations

"Time fractional diffusion equations have been widely used to model anomalous diffusions exhibiting sub-diffusive behavior, due to particle sticking and trapping phenomena. In this talk, I will discuss how anomalous sub-diffusions and the corresponding time-fractional differential equations arise naturally as limits of random walks in random media. I will then present some results on the probabilistic representation to the solutions of time fractional Poisson equations and estimates of their fundamental solutions. This talk is based on joint works with Z.-Q. Chen (Washington), P. Kim (Seoul) and J. Wang (Fuzhou). "

- Roland Bauerschmidt (Cambridge) 10:50-11:20

  Log-Sobolev inequalities for Euclidean field theories and spin models

  I will present an extension of the Bakry-Emery method for Log-Sobolev inequalities that applies to Euclidean field theories which are invariant measures of singular SPDEs. The method uses as input estimates on the renormalised potential which is the solution to Polchinski's continuous renormalisation group equation. Examples where this applies include the sine-Gordon model (with mass term) and the φ^4_d models in $d < 4$ (uniformly in the volume up to the critical point), and also the near-critical Ising model in $d > 4$. This talk is based on joint works in Thierry Bodineau and Benoit Dagallier.

- Seiichiro Kusuoka (kyoto) 11:30-12:00

  Construction of a non-Gaussian and rotation-invariant $\Phi - 4$-measure and associated flow on $\mathbb{R}^3$ through stochastic quantization

  In this talk, we construct the Φ^4_3-measure on $\mathbb{R}^3$ by approximations of interactions with localization and regularization. Here, we remark that for approximations, we do not apply scaling of a torus. As an advantage of our approximations, we can prove the rotation invariance of the Φ^4_3-measure. To prove the convergence of the approximations, we apply the stochastic quantization and the methods of singular stochastic PDEs. This is a joint work with Sergio Albeverio.

Thursday Afternoon

- Terry Lyons (Oxford/Turing institute) 2:00-2:50

  TBA

- Ajay Chandra (ICL) 3:20:3:50

  TBA

- Masato Hoshino (Osaka) 4:00-4:30

  Paracontrolled calculus and regularity structures

  We prove a general equivalence statement between the notions of models and modelled distributions over a regularity structure, and paracontrolled systems indexed by the regularity structure. The construction of a modelled distribution from a paracontrolled system is explicit, and takes a particularly simple form in the case of the regularity structures introduced by Bruned, Hairer and Zambotti for the study of singular stochastic partial differential equations. This talk is based on a joint work with Ismaël Bailleul (Université Rennes 1).

Friday Morning

- Mark Pollicott (Warwick) 9:30-10:20 **Zeta functions for closed geodesics**

  In 1956 Selberg defined a complex function of a single complex variable for closed Riemann surfaces of constant negative curvature by analogy to the famous Riemann zeta function in number theory. In Selberg's zeta function the closed geodesics play the role of prime numbers in the Riemann zeta functions. Over the past decade there has been progress in understanding the more general setting of variable negative curvature or surfaces with boundary and I will describe some of these results. This talk is intended for a general mathematical audience.

- Asma Hassannezhad (Bristol) 10:50-11:20

  A tour on Steklov eigenvalue problem

  We discuss the importance and the beauty of the Steklov eigenvalue problem and its connection to the Laplace eigenvalue problem. The talk will be a brief tour of some classic results and recent developments on the subject.

- Adam Harper (Warwick) 11:30-12:20

  TBA

Public Lecture (Friday Evening)

Embassy of Japan (Entrance strictly by registration)

- Martin Hairer (ICL) 5:15pm

  On Coin Tossing, Atoms and Forest Fires

- Hiroshi Ooguri (Caltech and Kavli IPMU) 6:00pm

  The Science of the Man from the 9 Dimensions

- Reception (18:50-20:00)