2017-18 Milliman Lectures

2017-18 Milliman Lecture I - Bridging scales: from microscopic dynamics to macroscopic laws

2017-18 Milliman Lecture II - An analyst's incursion into quantum field theory

2017-18 Milliman Lecture III - Renormalization: a BPHZ theorem for stochastic PDEs

Martin Hairer, Imperial College London

Martin Hairer FRS is Chair in Probability and Stochastic Analysis at Imperial College London. In 2014, Hairer was awarded the Fields Medal, the world's most prestigious mathematics award, for his "outstanding contributions to the theory of stochastic partial differential equations, and in particular for the creation of a theory of regularity structures for such equations." His other honors include the Whitehead Prize of the London Mathematical Society (2008), the Philip Leverhulme Prize (2008), the Wolfson Research Merit Award of the Royal Society (2009), the Fermat Prize (2013), and the Fröhlich Prize of the London Mathematical Society (2014). He was elected a Fellow of the Royal Society in 2014 and made an Honorary Knight Commander of the Order of the British Empire in 2017.

Lecture I - Bridging scales: from microscopic dynamics to macroscopic laws

October 30, 2017 - 4:00pm to 5:00pm
Miller 301

One fascinating aspect of probability theory is the universal aspect of the objects it allows us to construct. The most well-known example of this phenomenon is the central limit theorem: for a very large class of collections of random variables, additive functionals that only depend weakly on any one element of the collection exhibit Gaussian behaviour in the limit. When taking time evolution into account, it turns out that in certain "cross-over regimes" the large-scale behaviour of a number of stochastic systems can formally be described by an ill-posed stochastic PDE.

Lecture II - An analyst's incursion into quantum field theory

October 31, 2017 - 4:00pm to 5:00pm
Sieg 134

In quantum field theory, scattering amplitudes are described by sums over terms described by Feynman diagrams. In many cases, these are meant to describe singular divergent integrals, so it is not clear how they should be interpreted and whether different interpretations are equivalent. In the Euclidean context, we turn this into a clean problem of real analysis and show how algebraic techniques allow to tackle it.

Lecture III - Renormalization: a BPHZ theorem for stochastic PDEs

November 1, 2017 - 4:00pm to 5:00pm
Smith 211

We show how some of the ideas explored in the previous two lectures can be applied to the study of singular stochastic PDEs. In particular, we show that although it is not clear a priori what it means to "solve" any particular one of these equations, they can be divided into finite-dimensional families of solutions that are themselves defined in a canonical way. This is a consequence of a version of the celebrated "BPHZ theorem" which governs renormalisation techniques in perturbative QFT.

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