WHITEHEAD PRIZE: citation for Adam Harper

Short citation:
Dr Adam Harper, of the University of Warwick, is awarded a Whitehead Prize for his deep and important contributions to analytic number theory, and in particular for his work on the value distribution of the Riemann zeta-function and random multiplicative functions using sophisticated ideas and techniques from probability theory.

Long citation:
Dr Adam Harper, of the University of Warwick, is awarded a Whitehead Prize for his deep and important contributions to analytic number theory, and in particular for his work on the value distribution of the Riemann zeta-function and random multiplicative functions using sophisticated ideas and techniques from probability theory.

One of Dr Harper's most impressive results concerns the moments of the Riemann zeta-function on the critical line. This is a classical problem going back to Hardy and Littlewood. Dr Harper established upper bounds on the moments, conditional on the Riemann Hypothesis, which are striking in that they are of the same order as the conjectured asymptotics, and so are believed to be best possible. This represents a major breakthrough. Recently, he also employed novel methods from the theory of logarithmically correlated Gaussian fields to make substantial progress in characterising the extreme value statistics of the zeta function on short sections of the critical line, opening up a major new avenue of research.

In his work on minor arcs, mean values, and restriction theory for exponential sums over smooth numbers, Dr Harper used sophisticated ideas from harmonic analysis to accurately estimate non-integer moments (this time of an exponential sum) in a manner that seemed out of reach of previous techniques.

Dr Harper has also made important contributions to understanding the partial sums of random multiplicative functions. These include the proof of a remarkable conjecture of Helson which predicted that random multiplicative functions exhibit 'more than square-root cancellation', in that the expected L^1 norm of their partial sums should be asymptotically smaller than the square root of the number of terms being summed. This is a beautiful, deep and unexpected result: before his work it had not been clear whether Helson's conjecture was correct or not. His proof uses subtle connections with branching Brownian motion in probability and the emerging area of 'multiplicative chaos'.

Dr Harper is renowned for the clarity of his writing and his lectures.