Citation for Viveka Erlandsson (Whitehead Prize)

Short citation

Dr Viveka Erlandsson of the University of Bristol is awarded a Whitehead Prize for her outstanding work on curve counting on surfaces. She also established an extraordinary rigidity theorem for bounce sequences associated to billiard tables. Viveka Erlandsson is a leading figure in low-dimensional geometry, topology and dynamics.

Long citation

Dr Viveka Erlandsson, in collaboration with Juan Souto, introduced geodesic currents as an important tool for counting closed geodesics on hyperbolic surfaces. Counting closed geodesic of length less than a given bound L on a hyperbolic surface is a classical subject. The work of Grigory Margulis in the 1960s and 1970s exhibited the deep relation between counting problems and the dynamics of the geodesic flow. Around 20 years ago, Maryam Mirzakhani established surprising new counting results for simple closed geodesics on a hyperbolic surface.

Erlandsson and Souto used their technique to generalize Mirzakhani's results to a vast family of new 'length functions'. For example, their work applies to Riemannian metrics of negative curvature and to group-theoretic notions like stable translation length. They recently published a research monograph which gives a unified treatment of their work and Mirzakhani's work. Their techniques bear philosophical resemblances to those of Mirzakhani but are technically very different. Their techniques give deep new insights and yield numerous new applications. Their monograph is already a respected classic in the field.

Erlandsson, in collaboration with Duchin, Leininger and Sadanand, established a beautiful rigidity theorem for polygonal billiards. Given a polygon in the plane, one can record all possible bounce sequences for a billiard on the table. A bounce sequence simply records all the edges of the polygon the billiard encounters over time. The set of possible bounce sequences is called the bounce spectrum. They show that the bounce spectrum determines the polygon up to similarity, with the exception of right-angled polygons, which are only determined up to affine equivalence by their bounce spectrum. This is a very satisfying and complete resolution of this problem. One thing that distinguishes this result from other results of its type is that it applies to billiards on all polygons and does not require that the angles are rational.