

WHITEHEAD PRIZE: citation for Ben Davison

Short citation:

Dr Ben Davison, of the University of Edinburgh, is awarded a Whitehead Prize in recognition of his outstanding contributions to the foundations, the structure and applications of Donaldson–Thomas invariants.

Long citation:

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Donaldson–Thomas (DT) theory studies the rich structure arising from (enriched, enhanced, ...) enumerative invariants in settings of algebraic geometry or non-commutative algebra. Within this field, Davison's work has greatly enriched the theory and advanced the foundations, which in turn has allowed him to establish, deepen and exploit connections to cluster theory, representation theory, tropical geometry and mirror symmetry.

In a series of works, he establishes the ‘quantum positivity conjecture’, in its full strength in recent joint work with Travis Mandel. The conjecture is a positivity property for a distinguished basis of the quantum theta basis of a quantum cluster algebra, a purely combinatorial object. Davison's proof reinterprets the numbers arising in the conjecture as delicate Hodge-theoretic invariants of moduli spaces arising in DT theory. This categorification then allows him to combine methods from Hodge theory, wall-crossing, and scattering diagrams in tropical geometry.

In joint work with Meinhardt, he settled a conjecture by Kontsevich–Soibelman on integrality of DT invariants, one of the most subtle questions in the theory. Again, his work is based on proving a categorified version of the conjecture; at this categorical level, the statement then follows from a deep property of the Hodge structure of the stack of semistable objects.

Altogether, his work is a remarkable elucidation of the theory of DT invariants: both by clarifying the intrinsic properties of single invariants at the higher categorified level, and by providing us with new structures governing the behaviour of the collection of all DT invariants in a given setting.