De Morgan Medal: citation for Nigel Hitchin

Short citation:

Professor Nigel Hitchin FRS of the University of Oxford is awarded the De Morgan Medal for his deep contributions to differential geometry, bridging mathematics and theoretical physics, for opening many new avenues of research, and for his service to the mathematical community.

Long citation:

Professor Nigel Hitchin FRS of the University of Oxford is awarded the De Morgan Medal for his deep contributions to differential geometry, bridging mathematics and theoretical physics, for opening many new avenues of research, and for his service to the mathematical community.

Nigel Hitchin's work has had a profound impact across an extraordinarily wide range of modern mathematics and theoretical physics. The core of his expertise lies in the area of differential geometry and he has been the foremost differential geometer in the UK for four decades. He has been one of the leading figures in the extraordinary fusion of modern geometry and mathematical physics.

Hitchin's earlier work focused on the geometry of four-dimensional spaces. He was the leader in the development of the 'twistor 'techniques – introduced by Penrose in the context of Mathematical Physics – as a radically new idea in 4-dimensional Riemannian geometry. Prominent achievements from this period include his contribution to the immensely important ADHM construction of instanton solutions of the Yang–Mills equations and his deep extension of these ideas to the more difficult case of monopoles in three dimensions. He formulated what came to be known as the Kobayashi–Hitchin conjecture, relating the existence of solutions of a form of the Yang–Mills equations to the notion of stability in algebraic geometry. This has been an extraordinarily fruitful direction, providing a unifying framework for many ideas in complex differential geometry and pointing the way to proofs of central new results in this field over the past 30 years.

In the early 1980s, Hitchin introduced new lines of research which have been particularly fertile. The context of these was the classical theory of compact Riemann surfaces and algebraic curves. He introduced what are now called Hitchin pairs, consisting of a holomorphic vector bundle and a Higgs field, and the moduli spaces of such pairs. Hitchin found that these have extraordinarily rich properties and interact with a host of other developments which one would not otherwise see as having anything to do with each other, including integrable systems, representations of surface groups and hyperkähler geometry. The study of these interactions has been a flourishing research area since the appearance of Hitchin's paper. Perhaps most striking of all, variants of Hitchin's ideas led to the proof by Ngo of the so-called fundamental lemma in the Langlands programme, with implications in number theory.

Hitchin's seminal contributions have continued into the present century. In one direction he developed an extremely elegant new approach to exceptional geometric structures, which are of fundamental importance for 'M-theory 'in Mathematical Physics. In a parallel direction, Hitchin introduced the notion of generalised complex structures on manifolds, which provide an unexpected synthesis of complex and symplectic geometry.

There are very few mathematicians with a similar impact in mathematics as well as in theoretical physics. Nigel Hitchin has started several new areas of mathematics throughout his career and has built new bridges between mathematics and theoretical physics. He is a real giant in the mathematical research community.

Nigel Hitchin has also distinguished himself in his service to the mathematical community. He served as President of the London Mathematical Society and in many international advisory functions. Throughout his tenure as professor at Warwick University, Rouse Ball Professor at Cambridge University and as Savilian Professor of Geometry at Oxford University, Nigel Hitchin has been very successful as an advisor and mentor of young researchers. He has always been very supportive of the younger generations.

Nigel Hitchin is an outstanding mathematician in all aspects of the profession.