THE 2010 WOLF FOUNDATION PRIZE IN MATHEMATICS

The Prize Committee for Mathematics has unanimously decided that the 2010 Wolf Prize will be jointly awarded to:

Shing-Tung Yau
Harvard University
Cambridge, Massachusetts
USA

for his work in geometric analysis that has had a profound and dramatic impact on many areas of geometry and physics;

together with

Dennis Sullivan
Stony Brook University
Stony Brook, NY
USA

for his innovative contributions to algebraic topology and conformal dynamics.

Shing-Tung Yau (born 1949, China) has linked partial differential equations, geometry, and mathematical physics in a fundamentally new way, decisively shaping the field of geometric analysis. He has developed new analytical tools to solve several difficult nonlinear partial differential equations, particularly those of the Monge-Ampere type, critical to progress in Riemannian, Kahler and algebraic geometry and in algebraic topology, that radically transformed these fields. The Calabi-Yau manifolds, as these are known, a particular class of Kahler manifolds, have become a cornerstone of string theory aimed at understanding how the action of physical forces in a high-dimensional space might ultimately lead to our four-dimensional world of space and time. Prof. Yau's work on T-duality is an important ingredient for mirror symmetry, a fundamental problem at the interface of string theory and algebraic and symplectic geometry. While settling the positive mass and energy conjectures in general relativity, he also created powerful analytical tools, which have broad applications in the investigation of the global geometry of space-time.

Prof. Yau's eigenvalue and heat kernel estimates on Riemannian manifolds, count among the most profound achievements of analysis on manifolds . He studied minimal surfaces, solving several classical problems, and then used his results, to create a novel approach to geometric topology. Prof. Yau has been exceptionally productive over several decades, with results radiating onto many areas of pure and applied mathematics and theoretical physics. In addition to his diverse and fundamental mathematical achievements, which have inspired generations of mathematicians, Prof. Yau has also had an enormous impact, worldwide, on mathematical research, through training an extraordinary number of graduate students and establishing several active mathematical research centers.

Dennis Sullivan (born 1941, USA) has made fundamental contributions in many areas, especially in algebraic topology and dynamical systems. His early work helped lay the foundations for the surgery theory approach to the classification of higher dimensional manifolds, most particularly, providing a complete classification of simply connected manifolds within a given homotopy type. He developed the notions of localization and completion in homotopy theory, and used this theory to prove the Adams Conjecture (also proved independently by Quillen). Profs. Sullivan and Quillen introduced the rational homotopy type of space.

Sullivan showed that it can be computed using a minimal model of an associated differential graded algebra. Sullivan's ideas have had far-reaching influence and applications in algebraic topology. One of Sullivan's most important contributions was to forge the new mathematical techniques needed to rigorously establish the predictions of Feigenbaum's renormalization, as an explanation of the phenomenon of universality in dynamical systems. Sullivan's "no wandering domains theorem" settled the classification of dynamics for iterated rational maps of the Riemann sphere, solving a 60 year-old conjecture by Fatou and Julia. His work generated a surge of activity, by introducing quasiconformal methods to the field and establishing an inspiring dictionary between rational maps and Kleinian groups of continuing interest. His rigidity theorem for Kleinian groups has important applications in Teichmuller theory and for Thurston's geometrization program for 3-manifolds. His recent work on topological field theories and the formalism of string theory can be viewed as a byproduct of his quest for an ultimate understanding of the nature of space, and how it can be encoded in strange algebraic structures.

Sullivan's work has been consistently innovative and inspirational. Beyond the solution of difficult outstanding problems, his work has generated important and active areas of research, pursued by many mathematicians.