Shigefumi Mori – LMS Honorary Member citation

Short citation:

The London Mathematical Society has elected Professor Shigefumi Mori, of Kyoto University, Japan, to Honorary Membership. Professor Mori has made major advances in the field of algebraic geometry by developing the minimal model programme with insight that has opened up the understanding of higher-dimensional varieties from a completely new perspective.

Long citation:

The London Mathematical Society has elected Shigefumi Mori, of Kyoto University, to Honorary Membership. Professor Mori received his PhD under Masayoshi Nagata, and was awarded a Fields Medal at the 1990 ICM in Kyoto, returning there in the same year following a career at the Unirofessor Shigefumi Mori, of Kyoto University, Japanversity of Nagoya.

One of Mori's first achievements was to prove conjectures of Hartshorne and Frankel, characterising complex projective spaces as those varieties with ample tangent bundle, and therefore positive bisectional curvature. For this purpose, he had established the existence of rational (genus 0) curves on suitable varieties by a "bend and break" method.

The theory of complex surfaces had established the importance of the canonical class, and curves on a higher-dimensional variety fall into three types. Mori proved that the first (canonically negative) type can be represented by rational curves that generate the extremal rays of a homological cone. An analysis of their behaviour was the beginning of his work on the minimal model program (MMP), whereby any projective variety is birational to one without negative curves, or to a family of Fano varieties (those with ample canonical class).

Together with Shigeru Mukai, he completed the classification of smooth Fano 3-folds, which fall into 105 deformation types. With Yoichi Miyaoka, he showed that Fano varieties are uniruled, so that every point lies on a rational curve. Today, the classification of Fano varieties is a major technological endeavour, with applications to number theory.

Mori's seminal paper establishing the existence and construction of minimal models for 3-folds was published in 1988. It had required overcoming a minefield of technical difficulties that had already been understood by (in particular) Miles Reid and János Kollár. Singularities are inherent in the theory, and flips (operations arising from geometric invariant theory) are needed to run MMP. The latter has acquired increasing momentum, and its focus on rational curves has helped motivate progress in Gromov-Witten theory and the parallel field of symplectic geometry.