



THE  
ABEL  
PRIZE  
2013

The Norwegian Academy of Science and Letters has decided  
to award the Abel Prize for 2013 to

## Pierre Deligne

Institute for Advanced Study, Princeton, New Jersey, USA

**“for seminal contributions to algebraic geometry and for their transformative impact  
on number theory, representation theory, and related fields”**

Geometric objects such as lines, circles and spheres can be described by simple algebraic equations. The resulting fundamental connection between geometry and algebra led to the development of algebraic geometry, in which geometric methods are used to study solutions of polynomial equations, and, conversely, algebraic techniques are applied to analyze geometric objects.

Over time, algebraic geometry has undergone several transformations and expansions, and has become a central subject with deep connections to almost every area of mathematics. Pierre Deligne played a crucial role in many of these developments.

Deligne's best known achievement is his spectacular solution of the last and deepest of the Weil conjectures, namely the analogue of the Riemann hypothesis for algebraic varieties over a finite field. Weil envisioned that the proof of these conjectures would require methods from algebraic topology. In this spirit, Grothendieck and his school developed the theory of  $\ell$ -adic cohomology, which would then become a basic tool in Deligne's proof. Deligne's brilliant work is a real tour de force and sheds new light on the cohomology of algebraic varieties. The Weil conjectures have many important applications in number theory, including the solution of the Ramanujan-Petersson conjecture and the estimation of exponential sums.

In a series of papers, Deligne showed that the cohomology of singular, non-compact varieties possesses a mixed Hodge structure that generalized the classical Hodge theory. The theory of mixed Hodge structures is now a basic and powerful tool in algebraic geometry and has yielded a deeper understanding of cohomology. It was also used by Cattani, Deligne and Kaplan to prove an algebraicity theorem that provides strong evidence for the Hodge conjecture.

With Beilinson, Bernstein and Gabber, Deligne made definitive contributions to the theory of perverse sheaves. This theory plays an important role in the recent proof of the fundamental lemma by Ngo. It was also used by Deligne himself to greatly clarify the nature of the Riemann-Hilbert correspondence, which extends Hilbert's 21st problem to higher dimensions. Deligne and Lusztig used  $\ell$ -adic cohomology to construct linear representations for general finite groups of Lie type. With Mumford, Deligne introduced the notion of an algebraic stack to prove that the moduli space of stable curves is compact. These and many other contributions have had a profound impact on algebraic geometry and related fields.

Deligne's powerful concepts, ideas, results and methods continue to influence the development of algebraic geometry, as well as mathematics as a whole.

