



"Pure mathematics does not have a direct impact on people's lives, because we think of the questions for themselves, and are not motivated by their applications. But like with any good idea, these too will add value in their own way, and eventually impact the way the subject is taught."

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In collaboration with J. P. Wintenberger, Prof. Chandrashekhar B. Khare settled the Serre conjecture, formulated by mathematician, Jean-Pierre Serre, in the affirmative. Prof. Khare's work is a major breakthrough in the field with many spectacular consequences, and many new ideas introduced in it are expected to dominate the field for years to come.



Unlocking puzzles in number theory



Number theory is widely considered to be one of the most challenging and exciting fields of mathematics. Among the many challenging puzzles in number theory, a long standing one has been the Serre conjecture.

The Serre conjecture is named after the French mathematician Jean-Pierre Serre who formulated it in the 1970s. The conjecture essentially postulated a surprising connection between solutions of some polynomial equations and analytic functions with symmetry properties. Put simply, the former are equations that contain positive integers with operations such as addition, subtraction and multiplication but not division while analytic functions are functions that are given by a convergent power series and can be thought of as bridges between polynomials and general functions.

Mathematicians spent the next couple of decades grappling with the solution to the conjecture. In 2009, Prof. Khare along with his French colleague J. P. Wintenberger solved the Serre conjecture.

The connection between solutions of polynomial equations and symmetry was first discovered in the 19th century by Evariste Galois who interestingly enough died in a duel at the age of 21 and wrote down his ideas the night before he died. He developed the idea of the symmetry group of a polynomial. Groups are a technical term which represents a group of permutations. Groups are one of the central objects of current mathematics.

The Serre conjecture implies the truth of Fermat's last theorem, a notoriously puzzling conundrum that had mathematicians flummoxed until it was solved by A. Wiles in 1993, more than three hundred years after it was first formulated. The conjecture builds a bridge between algebra and geometry on one hand and analysis on the other.

Though number theory and the idea of groups may seem very abstract, it is these theories that were used to invent things like public key cryptography which is used to ensure information security when you use credit cards on the internet.