# Manjul Bhargava: A Journey Of Unparalleled Brilliance

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**Abstract: -**

In the heart of Hamilton, Ontario, Canada, a young boy named Manjul Bhargava was born to a family destined to make its mark on the world of mathematics. His mother, Mira Bhargava, a mathematician herself, introduced him to the enchanting world of numbers at an early age. Manjul's fascination with mathematics blossomed, and he quickly displayed an extraordinary talent for problem-solving and abstract thinking.

Even as a child, Manjul's mathematical prowess was evident. He completed all of his high school math and computer science courses by the age of 14, earning him a place at Plainedge High School in North Massapequa, where he graduated as valedictorian. His academic journey continued at Harvard University, where he earned his Bachelor of Arts degree in 1996.

Manjul's brilliance caught the attention of renowned mathematician Andrew Wiles, who mentored him during his graduate studies at Princeton University. Under Wiles guidance, Manjul delved into the depths of number theory, a field that explores the properties of integers and their relationships. His doctoral thesis, which generalized the classical Gauss composition law for quadratic forms, was a groundbreaking achievement that earned him the Clay Research Fellowship and the Clay Research Award in 2005.

In 2003, at the tender age of 29, Manjul Bhargava became the youngest full professor of mathematics at Princeton University. His appointment marked a new era in the history of the university, as he joined the ranks of illustrious mathematicians who had shaped the field.

**Keywords: -** Blossome, Extraordinary, Talent Valedictorian, Brilliance, Delve, Achievement .

**Introduction: -**

Manjul Bhargava FRS (born 8 August 1974) is a Canadian-American mathematician. He is the Brandon Fradd, Class of 1983, Professor of Mathematics at Princeton University, the Stieltjes Professor of Number Theory at Leiden University, and also holds Adjunct Professorships at the Tata Institute of Fundamental Research, the Indian Institute of Technology Bombay, and the University of Hyderabad. He is known primarily for his contributions to number theory.

Bhargava was awarded the Fields Medal in 2014. According to the International Mathematical Union citation, he was awarded the prize "for developing powerful new methods in the geometry of numbers, which he applied to count rings of small rank and to bound the average rank of elliptic curves". He was also a member of the Padma Award committee in 2023.

## Education and career:-

Bhargava was born to an Indian family in Hamilton, Ontario, Canada, but grew up and attended school primarily on Long Island, New York. His mother Mira Bhargava, a mathematician at Hofstra University, was his first mathematics teacher. He completed all of his high school math and computer science courses by age 14. He attended Plainedge High School in North Massapequa, and graduated in 1992 as the class valedictorian. He obtained his AB from Harvard University in 1996. For his research as an undergraduate, he was awarded the 1996 Morgan Prize. Bhargava went on to pursue graduate studies at Princeton University, where he completed a doctoral dissertation titled "Higher composition laws" under the supervision of Andrew Wiles and received his PhD in 2001, with the support of a Hertz Fellowship. He was a visiting scholar at the Institute for Advanced Study in 2001-02, and at Harvard University in 2002-03. Princeton appointed him as a tenured Full Professor in 2003. He was appointed to the Stieltjes Chair in Leiden University in 2010.

Bhargava has also studied the tabla under gurus such as Zakir Hussain. He also studied Sanskrit from his grandfather Purushottam Lal Bhargava, a scholar of Sanskrit and ancient Indian history. He is an admirer of Sanskrit poetry.

## Career and research

Bhargava's Ph.D thesis generalized Gauss's classical law for composition of binary quadratic forms to many other situations. One major use of his results is the parametrization of quartic and quintic orders in number fields, thus allowing the study of the asymptotic behavior of the arithmetic properties of these orders and fields.

His research also includes fundamental contributions to the representation theory of quadratic forms, to interpolation problems and p-adic analysis, to the study of ideal class groups of algebraic number fields, and to the arithmetic theory of elliptic curves. A short list of his specific mathematical contributions are:

• Fourteen new Gauss-style composition laws.

• Determination of the asymptotic density of discriminants of quartic and quintic number fields.

Proofs of the first-known cases of the Cohen-Lenstra-Martinet heuristics for class groups.

• Proof of the 15 theorem, including an extension of the theorem to other number sets such as the odd numbers and the prime numbers.

Proof of the 290 theorem.

A novel generalization of the factorial function, Bhargava factorial, al providing an answer to a decades-old question of George Pólya.

Proof (with Arul Shankar) that the average rank of all elliptic curves over Q (when ordered by height) is bounded.

Proof that most hyperelliptic curves over Q have no rational points.

In 2015, Manjul Bhargava and Arul Shankar proved the Birch and Swinnerton-Dyer conjecture for a positive proportion of elliptic curves.

## Awards and honours

Bhargava has won several awards for his research, the most prestigious being the Fields Medal, the highest award in the field of mathematics, which he won in 2014.

He received the Morgan Prize in 1996. and Hertz Fellowship He was named one of Popular Science magazine's "Brilliant 10" in November 2002. He then received a Clay 5- year Research Fellowship and the Merten M. Hasse Prize from the MAA in 2003, the Clay Research Award, the SASTRA Ramanujan Prize,

and the Leonard M. and Eleanor B. Blumenthal Award for the Advancement of Research in Pure Mathematics in 2005.

**Peter Sarmak of Princeton University has said of Bhargava:**

"At mathematics he's at the very top end. For a guy so young I can't remember anybody so decorated at his age. He certainly started out with a bang and has not let it get to his head, which is unusual. Of course he couldn't do what he does if he wasn't brilliant. It's his exceptional talent that's so."

In 2008, Bhargava was awarded the American Mathematical Society's Cole Prize The citation reads:

"Bhargava's original and surprising contribution is the discovery of laws of composition on forms of higher degree. His techniques and insights into this question are dazzling: even in the case considered by Gauss, they lead to a new and clearer presentation of that theory."

In 2009, he was awarded the Face of the Future award at the India Abroad Person of the Year ceremony in New York City. In 2014, the same publication gave the India Abroad Publisher's Prize for Special Excellence.

In 2011, he was awarded the Fermat Prize for "various generalizations of the Davenport- Heilbronn estimates and for his startling recent results (with Arul Shankar) on the average rank of elliptic curves". In 2012, Bhargava was named an inaugural recipient of the Simons Investigator Award, and became a fellow of the American Mathematical Society in its inaugural class of fellows. He was awarded the 2012 Infosys Prize in mathematics for his "extraordinarily original work in algebraic number theory, which has revolutionized the way in which number fields and elliptic curves are counted".

In 2013, he was elected to the National Academy of Sciences.

In 2014, Bhargava was awarded the Fields Medal at the International Congress of Mathematicians in Seoull151 for "developing powerful new methods in the geometry of numbers, which he applied to count rings of small rank and to bound the average rank of elliptic curves".

In 2015, he was awarded the Padma Bhushan, the third-highest civilian award of India.

In 2017, Bhargava was elected as a member of the American Academy of Arts and Sciences, last In 2018, Bhargava was named as the inaugural occupant of The Distinguished Chair for the Public Dissemination of Mathematics at The National Museum of Mathematics (MoMath). This is the first visiting professorship in the United States dedicated exclusively to raising public awareness of mathematics . Bhargava was conferred a Fellowship at the Royal Society in 2019.

## A Legacy of Inspiration

Manjul Bhargava's contributions to mathematics are not only significant in themselves but also serve as a source of inspiration for young mathematicians around the world. His dedication to his craft, his innovative approach to problem- solving, and his ability to bridge the gap between different fields of mathematics have made him a role model
for many.

As a professor at Princeton University, Bhargava is committed to nentoring and guiding the next generation of mathematicians. He is passionate about sharing his knowledge and enthusiasm for mathematics with his students, encouraging them to explore the depths of this fascinating subject.

Manjul Bhargava's journey from a curious child to a world-renowned mathematician is a testament to the power of human curiosity, perseverance, and dedication. His achievements have not only enriched the field of mathematics but also demonstrated the boundless possibilities that can be achieved through the pursuit of knowledge and understanding.

**Conclusion: -**

Manjul Bhargava's groundbreaking research has significantly advanced the field of number theory. His innovative approach and deep understanding of the subject have led to profound insights and solutions to long-standing problems. Beyond his mathematical achievements, Bhargava's commitment to education and his dedication to nurturing young talent make .

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