

# Professor Neena Gupta, Infosys Prize Laureate for Cracking the Zariski Code, One of Math's Long-Lasting Problems: A Bio-Bibliographic Exploration

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## ABSTRACT

**Aim:** Dr. Neena Gupta, a prominent figure in 2024 often called the "Queen of Algebra," has authored 46 research papers between 2011 and 2025. This study presents a bibliometric analysis to provide a quantitative overview and construct her scientific profile. **Background:** For over six decades, the "Zariski Cancellation Problem (1949)" remained unsolved until Dr. Gupta achieved a major breakthrough in 2014 by solving a version in positive characteristic. She was honored with the Infosys Prize in Mathematical Sciences in 2024. **Methodology:** This study analyzes 46 publications from 2011 to 2025 using data from ResearchGate, Google Scholar, and her official website. Standard bibliometric methods were applied to examine research output. **Results:** Dr. Gupta has published 46 papers (11 single-authored, 8 as first author). Peak productivity occurred in 2023 and 2024. Key indicators include: DC (0.76), CC (0.43), CI (2.11), and MCC (0.44). Her most cited 2014 paper has 97 citations. **Conclusion:** Dr. Gupta is a leading figure in modern mathematics whose impactful publications and prestigious honors inspire future generations, especially women in STEM.

**Keywords:** Affine Algebraic Geometry, Bethune College Kolkata, Calcutta University, Commutative Algebra, Indian Mathematician, Infosys Prize Laureate, ISI Kolkata, Neena Gupta, Oscar Zariski, TIFR Mumbai, Woman Mathematician, Zariski Cancellation Problem, Zariski Code.

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## INTRODUCTION

The Zariski Cancellation Problem is a famous question in algebraic geometry that was first asked in 1949 by Oscar Zariski, a Russian-born American mathematician who helped shape the field. For more than 60 years, many mathematicians tried to solve it without success. In 2014, a mathematician from Kolkata, Neena Gupta, solved this difficult problem. Her work focused on a version of the problem in positive characteristic, a specific area of algebraic geometry. Her breakthrough was widely praised around the world as a major achievement. Neena Gupta, now 41 years old, gained international acclaim for solving this long-standing mathematical problem, and in recognition of her remarkable contributions, she was awarded the Infosys Prize 2024 in Mathematical Sciences (Infosys Science Foundation, 2025; Dutta, 2025; Mitra, 2024). This episode starts with/ about Neena Gupta, Professor of Indian Statistical Institute (ISI), Kolkata, the

youngest mathematician cum scientist (age 41 years) so far. She is the much-discussed genius in mathematics of today and is pride for Indian mathematical community as well West Bengal.

### Oscar Zariski

Oscar Zariski (April 24, 1899 – July 4, 1986) was a Russian-born American mathematician and one of the most important figures in algebraic geometry during the 20<sup>th</sup> century (Wikipedia, 2025a). Along with André Weil, Zariski helped transform algebraic geometry by giving it a solid foundation based on algebra. Just like Descartes used basic algebra to create coordinate geometry, Zariski used modern commutative algebra—a subject developed by Emmy Noether and W. Krull—to build a more rigorous version of algebraic geometry. In addition to making major contributions to both algebra and geometry, Zariski also trained many leading mathematicians of the 20<sup>th</sup> century (Dutta, 2025; Wikipedia, 2025a).

### Zariski Cancellation Problem

The Zariski Cancellation Problem asks whether, if two algebraic varieties become isomorphic after adding a variable, they were isomorphic to begin with. Prof. A. K Dutta of ISI Kolkata has discussed about the “Zariski Cancellation Problem” in his



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valuable paper (Dutta, 2025). *The Zariski Cancellation Problem* is a fundamental question in *algebraic geometry and commutative algebra*, named after Oscar Zariski (Zariski and Samuel, 1958/1960; Gupta, 2015, 2022). It asks:

If two algebraic varieties  $X$  and  $Y$  satisfy:

$$X \times A^1 \cong Y \times A^1,$$

does it imply that  $X \cong Y$ ?

In simpler terms, if adding an extra variable (or dimension) to two geometric objects makes them look the same, were they already the same to begin with?

Here,

$A^1$  is the affine line (similar to the real number line in algebraic geometry).

$A^1$  represents the product of a variety with a line, increasing its dimension by 1.

This is called *cancellation* because one is "cancelling" the affine line factor  $A^1$ .

### Affine Algebraic Geometry

Affine Algebraic Geometry is a branch of algebraic geometry that focuses on algebraic varieties defined in affine space. It studies the solutions to systems of polynomial equations over a field, using tools from commutative algebra and geometry. The affine space  $A_n^k$  over a field  $k$  is simply  $k^n$ , thought of as the set of all  $n$ -tuples of elements of  $k$ . But unlike vector space, affine space does not have a distinguished origin; it's more flexible.

Dr. A. K. Dutta, her guide and philosopher explained the idea well in his 2025 paper (Dutta, 2025). He described affine algebraic geometry as a branch of algebraic geometry that is closely linked to commutative algebra. In simple terms, it studies the properties of affine spaces, which are geometric objects defined using algebra. These spaces are built over either a field or a ring. A field is a set of numbers, like the real numbers  $R$ , complex numbers  $C$ , or rational numbers  $Q$ , where you can add, subtract, multiply, and divide (except by zero). A ring, such as the set of integers, also allows addition, subtraction, and multiplication, but not always division.

### Early Life and Her Family

Dr. (Mrs.) Neena Gupta was born on 24 November 1984 in Alambazar, Baranagar, near the famous Dakshineswar Temple in Kolkata. She comes from the Marwari community, with family roots in Jhunjhunu district, Rajasthan. Her father, Satya Narayan Gupta, worked in Kolkata, and she grew up in a modest middle-class household with her two brothers, Rohit and Amit. Neena fondly remembers how her father would challenge them with fun math puzzles, while her mother, Gyanlata, taught all three children up to Class X. She attended Khalsa Model Senior

Secondary School from nursery to Class XII, where mathematics was always her favourite subject. After finishing school in 2003, she pursued a BSc in Mathematics Honours at Bethune College, a historic women's college affiliated with Calcutta University in 2006. Neena Gupta graduated with top honors, standing First Class First in her B.Sc. (Honours) in Mathematics from Bethune College. Her academic excellence earned her numerous medals and book prizes. She then completed the M.Math program at the Indian Statistical Institute (ISI), Kolkata, in 2008, receiving the Gold Medal for best performance in her batch. That same year, she was selected for the PhD program at the Tata Institute of Fundamental Research (TIFR), awarded the prestigious Shyama Prasad Mukherjee Fellowship (SPMF) by CSIR, and also offered the Special Research Fellowship from ISI for outstanding doctoral candidates. She chose to pursue her PhD at ISI Kolkata under the SPMF. During her M.Math studies, Neena developed a strong interest in Number Theory and Algebra. As ISI Kolkata did not have a professional number theorist at the time, she chose to work in Commutative Algebra and Affine Algebraic Geometry under the supervision of Dr. A.K. Dutta. She was awarded her PhD in February 2012. The title of her thesis was "*Some results on Laurent polynomial fibrations and Quasi  $A^*$ -algebras*" (Dutta, 2025; Tandon, 2021; Wikipedia, 2025; ISI, n.d.).

### Professional Career

Dr. (Mrs.) Gupta is a Professor in Theoretical Statistical and Mathematics Unit of Indian Statistical Institute, Kolkata, Barrackpore Trunk Road since June 2022. Prior to that, she worked as Associate Professor in the same unit from 2014 to 2022. Gupta has been a professor in the Statistical and Mathematics Unit of ISI Kolkata since June 2014. She worked as INSPIRE faculty at ISI Kolkata during December 2012 to June 2014. Dr. Gupta also was a visiting fellow at TIFR Mumbai from May 2012 to December 2012. Before that she was a visiting Scientist at ISI Kolkata for the time span of February 2012 to April 2012. Apart from that she was Shyama Prasad Mukherjee Research Fellow at ISI Kolkata for the period of September 2008 to February 2012 (Wikipedia, 2025; SCRIBD, 2024; ISI, n.d.).

### Neena Gupta's Research and Solution for the Zariski Cancellation Problem

For 60 years, the Zariski Cancellation Problem remained unsolved-until Dr. Neena Gupta from ISI Kolkata made a major breakthrough. In 2014, she proved that a 3-dimensional affine variety created by mathematician Asanuma gives a negative answer to this problem in positive characteristic. Her contributions introduced novel perspectives in algebraic geometry and commutative algebra. Building upon Zariski's foundational work, Dr. Neena Gupta significantly advanced the modern understanding and resolution of the problem in positive characteristic, as outlined in her 2015 survey and 2022 exposition (Gupta, 2015, 2022). Her findings revealed surprising

links between different ideas in mathematics and helped deepen our understanding of the field (Infosys Science Foundation, 2025). According to Chandrashekhar Khare, Jury Chair for Mathematical Sciences, “Prof. Neena Gupta’s work has had a big impact in algebraic geometry, especially through her solution to the long-standing Zariski Cancellation Problem.” (Dutta, 2025). Dr. Neena Gupta carried out all her research in India but largest number of her publications emanated from abroad, and has become a source of inspiration for young people interested in pursuing fundamental research in pure sciences. Her biography and research contributions are available on platforms such as Wikipedia, Google Scholar, and ResearchGate. Recently, she has also gained widespread attention across various media and social platforms for her exceptional achievements in mathematics. This bio-bibliometric portrait is a humble tribute to Dr. Gupta, aiming to highlight her contributions and inspire future generations of researchers in the country.

## Objectives

The main objectives of this study are:

- To find year and age wise publications of Dr. Neena Gupta,
- To observe her position as main author and co-author,
- To calculate the degree of collaboration,
- To measure author productivity,
- To find the research team with co-authors,
- To identify the preferred publication channels,
- To obtain DC, CI, CC, and MCC for her authorship pattern,
- To analyze citation received or ‘cited by’ including CGR,
- To determine top cited scholarly works.

## REVIEW OF LITERATURE

Over the years, numerous bibliometric and scientometric studies have been conducted by librarians and information scientists to examine the scholarly contributions of distinguished individuals across diverse disciplines. These studies, primarily subject-oriented, underscore a sustained interest in assessing the academic impact and intellectual output of eminent personalities using bibliometric approaches.

Srimurugan and Nattar (2008) conducted an early study analysing the research productivity of Dr. K. Veluthambi, a renowned plant biologist. This was followed by Hazarika, Sarma, and Sen (2010), who examined the scientific output of Dr. Nayana Nanda Borthakur, a noted biometeorologist. In the same year, Sangam and Savanur (2010) undertook a bibliometric investigation of Eugene Garfield, a pioneering figure widely acknowledged as

the founder of bibliometrics and scientometrics. Mukherjee (2013) contributed to this field by analysing the research output of Prof. Lalit Singh, further expanding the scope of bibliometric profiling in Indian academia. Subsequently, Manjunath and Ramesha (2015) conducted a comprehensive study of Nobel Laureate Sir C. V. Raman, focusing on his biographical details and scholarly contributions. A significant addition came from Mondal, Raychoudhury, and Sarkhel (2018), who presented a biobibliometric profile of Prof. P. C. Mahalanobis, the eminent Indian statistician. This was followed by Dutta (2019), who documented the academic legacy of Prof. B. K. Sen, a prominent librarian and scientometrician. In recent years, the scope of such studies has continued to diversify. Teli and Maity (2021) carried out a bibliometric analysis of Stephen William Hawking, a globally acclaimed theoretical physicist. Huded *et al.* (2023) explored the research contributions of Prof. Madhav Gadgil, an ecologist and environmental scientist. Koley (2023, 2024) significantly broadened the spectrum of subjects by profiling notable personalities from the fields of medicine and law, including Prof. Dilip Mahalanobis (pioneer of Oral Rehydration Solution), and Justice Fali Sam Nariman (India’s first Additional Solicitor General) and Dr. Raj Chandra Bose, American-Indian Mathematical Statistician and one of the Euler’s theory breaker. Behera and Meher (2024) provided insights into the scholarly influence of Dr. Raghuram Rajan, an esteemed economist and former Governor of the Reserve Bank of India. Most recently, Koley (2025) presented a bio-bibliographic study on Dr. Suprabhat Mukherjee, a researcher specializing in colon cancer, reflecting the continuing evolution and interdisciplinary reach of bibliometric research.

Despite this rich body of work covering diverse scientific domains and personalities, no bibliometric study has yet been conducted on Dr. Neena Gupta, a young and acclaimed mathematician known for her contributions to algebraic geometry and commutative algebra. This gap presents a unique opportunity for an original and timely scientometric assessment of her research output and impact. Given her recognition in the global mathematical community, such a study would be both relevant and valuable in the context of emerging research in mathematical sciences.

## Methodology

### Data Collection

This study covers 46 publications of Dr. Neena Gupta in mathematical sciences during the period 2011-2025. All the publications have been extracted from ResearchGate (RG), Google Scholar (GS) databases and scientist’s web site. His publications include 07 journal articles, 03 conference proceedings, 01 poster presentations, 01 dissertation published in different publication media in India and abroad. In addition, other data has been collected from various offline and online sources. A compiled data sheet of his publications was prepared for this study. Then

all data were taken into MS-excel and Words, and tabulated for reaching to the points as per objectives of this study. Finally, finding statements are prepared one by one and discussed in the following sections.

**Statistical Analysis**

This study employs bibliometric formulas for Productivity Co-efficient, Average Annual Productivity, Collaboration Index (CI), Collaboration Co-efficient (CC), and Modified Collaboration Coefficient (MCC).

**Ethical Statement**

This study is based on publicly available bibliographic data and does not involve human subjects, thus requiring no ethical approval.

**Results**

The following tabulated data reveals some key factors.

**Year- and Age-wise Distribution of Publications**

Table 1 shows year and age-wise number of papers including co-authors and Degree of collaboration. During the short time span of 15 years, Neema has published 46 papers, of which 35 are multi-authored papers. Total 51 co-authors were involved for this purpose. Figure 1 represents year-and-age wise publications of Dr. Neena Gupta.

**Productivity Co-efficient (PC)**

PC = FPA / total PPA. As she published 50% of the total papers 46 i.e. 23 by the end of the year 2019, her FPA age is 35. PPA =15. Here, PC = 35/15 = 2.33.

**Average Annual Productivity (AAP)**

AAP = Total Papers/ Total paper productive age = 46/15 = 3.07

**Authorship Pattern**

Authorship pattern is meant for the number of authors per paper. Table 2 highlights types of papers according to the number of authors of papers.

**Status of By-line of Author**

In multi-authored publications, the order in which authors are listed often reflects the level of their intellectual contribution to the work. Ideally, the sequence should represent the relative input of each contributor. Table 3 presents the authorship positions held by Neena in her collaborative publications.

**CI, CC and MCC**

Using the following formulas (Yadavet *al.*, 2019; Ravichandra and Rajendra, 2024; Ajiferukeet *al.*, 1988), value of Collaboration Index (CI), Collaboration Co-efficient (CC) and Modified Collaboration Coefficient (MCC) are calculated and listed in Table 4. From the observed data set of the Table 4, the following bibliometric indicators are obtained with examples.

**Table 1:Year- and Age-wise list of publications.**

Year	TP	CP	AA (b.1984)	PPA	SAP	MAP	Authorship Status			CoA	DC= MAP/TP
							1 <sup>st</sup>	2 <sup>nd</sup>	4 <sup>th</sup>		
2011	1	1	27	1		1		1		1	1.00
2012	3	4	28	2	1	2		2		3	0.67
2013	1	5	29	3	1						0.00
2014	5	10	30	4	4	1		1		1	0.20
2015	3	13	31	5	1	2		2		2	0.67
2017	3	16	33	7		3		3		4	1.00
2018	4	20	34	8		4		4		6	1.00
2019	3	23	35	9		3	2		1	5	1.00
2020	5	28	36	10		5	2	3		9	1.00
2021	3	31	37	11		3	1		2	5	1.00
2022	2	33	38	12	1	1		1		1	0.50
2023	6	39	39	13	1	5	1	4		5	0.83
2024	6	45	40	14	1	5	1	4		9	0.83
2025	1	46	41	15	1						0.00
Total	46				11	35	7	25	3	51	0.76

**Collaboration Index (CI)**

Collaborative Index (CI) is the average number of authors per article in a given set of publications. It serves as a basic indicator of collaborative activity in research.

$$\text{Symbolically, } CI = \sum_{j=1}^n (j f_j) / N$$

Where,

$j$  = number of authors in an article (i.e. 1, 2, 3...).

$f_j$  = count of papers with  $j$  authors, and.

$N$  = total number of papers.

$A$  = the total number of authors per article.

For example,

$$\begin{aligned} \text{CI for 2012} &= [1 \times 1 + 2 \times 1 + 3 \times 1] \div 3 \\ &= 6 \div 3 = 2 \text{ and so on.} \end{aligned}$$

[Note that, 1 for single- authored paper, 2 for two authored papers, etc.]

**Collaboration Co-efficient (CC)**

It quantifies the proportion of multi-authored papers in relation to the total number of papers published, helping to assess the extent of collaborative research within a given dataset or discipline.

$$\text{Symbolically, } CC = 1 - [\sum_{j=1}^n (1/j) f_j / N]$$

Where,

$j$  = the number authors in an article i.e. 1, 2, 3 .....

$f_j$  = the number of  $j$  authored articles.

$N$  = the total number of articles published in a year.

For example,

$$\text{CC for 2012} = 1 - \{[(1 \div 1 \times 1) + (1 \div 2 \times 1) + (1 \div 3 \times 1)] \div 3\}$$

$$= 1 - \{[(1 + 1/2 + 1/3)] \div 3\}$$

$$= 1 - \{[1 + 0.50 + 0.33] \div 3\}$$

$$= 1 - \{1.83 \div 3\} = 1 - 0.61 = 0.39 \text{ and so on.}$$

This metric is often used in bibliometric studies to understand collaboration trends across authors, institutions, or countries.

**Modified Collaboration Coefficient (MCC)**

The MCC is a bibliometric indicator used to measure the degree of collaboration in scientific research. It's a refinement of the original Collaboration Coefficient (CC), which quantifies the extent of co-authorship in scholarly publications.

Symbolically,

$$\text{MCC} = \{1 - (1/N) \times [\sum_{j=1}^n (1/j) f_j]\} \text{ or } \{1 - (1/N) \times CC\}$$

For example,

$$\text{MCC for 2012} = [3 \div (3-1)] \times 0.39 = 3/2 \times 0.39 = 1.5 \times 0.39 = 0.585 \text{ or } 0.59 \text{ and so on.}$$

MCC interprets three levels of collaborations using the following approximate standard value of MCC (Ajiferuke *et al.*, 1988; Savanur and Srikanth, 2010) viz, The Modified Collaboration Coefficient (MCC) classifies research collaboration into three levels based on approximate values: low collaboration (MCC  $\approx$  0.00-0.30), indicating predominantly single-authored works; moderate collaboration (MCC  $\approx$  0.31-0.60), reflecting a balance between individual and joint research; and high collaboration (MCC  $\approx$  0.61-1.00), where multi-authored publications dominate (Ajiferuke *et al.*, 1988; Savanur and Srikanth, 2010).

**Rank wise Closest Collaborators**

Table 5 shows the number of co-authors Dr. Neena Gupta has worked with, the time period of their collaboration, and how many papers they published each year.

**Table 2: Authorship pattern.**

Number of authors	Single	Two	Three	Four	Total
Non-collaborative papers	11				11
Collaborative papers		21	12	2	35
Time span (Total)	2012-2025	2011-2023	2012-2024	2019-2021	
Year-range	14	13	13	3	

**Table 3: Neena's position in by-line of authors.**

Authorship pattern	Positions in By-line of authors			
	1st	2nd	4th	Total
Two-authored	7	14		21
Three-authored	1	11		12
Four-authored			2	2
Total	08	25	02	35

**Communication Channels and Different Indicators**

Publication Types and Platforms Table 6 outlines the range of platforms used for disseminating the researcher's work, along with their respective h-index, impact factor (IF), and country of origin. Out of a total of 46 publications, 13 (approximately 28%) appeared in peer-reviewed journals, one each in a book chapter and a conference proceeding, while 17 papers were shared as

preprints. This suggests a balanced mix of formal and informal communication channels, with a notable emphasis on early-stage dissemination through preprints.

**Publication Concentration (PBC)**

PBC is percentage of (the ratio of the Communication Channels (CC) consisting half of the papers to the total number of CC). Here,  $PBC = (9/16) \times 100 = 56.25$

**Table 4: Calculation value of CC, CI and MCC in collaboration of Neena's research Team.**

Year	Total	Authorship Pattern				Bibliometric Indicators		
		I	II	III	IV	CC	CI	MCC
2011	1		1			0.50	2.00	0.00
2012	3	1	1	1		0.39	2.00	0.59
2013	1	1				0.00	1.00	0.00
2014	5	4	1			0.10	1.20	0.13
2015	3	1	2			0.33	1.67	0.49
2017	3		2	1		0.55	2.33	0.83
2018	4		2	2		0.58	2.50	0.77
2019	3		2		1	0.58	2.67	0.87
2020	5		1	4		0.63	2.80	0.79
2021	3		2		1	0.58	2.67	0.87
2022	2	1	1			0.25	1.50	0.50
2023	6	1	5			0.42	1.83	0.50
2024	6	1	1	4		0.53	2.50	0.64
2025	1	1				0.00	1.00	0.00
Total	46	11	21	12	2	0.43	2.11	0.44

**Table 5: Rank list of co-authors of Neena.**

Sl. No.	Co-author's Name	Papers	YFP	YLP	Time Span	Paper/ Year
1	Amartya Kumar Dutta	9	2012	2020	9	1.00
2	Parnashree Ghosh	9	2022	2024	3	3.00
3	Nikhilesh Dasgupta	6	2017	2021	5	1.20
4	Ananya Pal	5	2024	2024	1	5.00
5	SM Bhatwadekar	4	2011	2017	7	0.57
6	Sourav Sen	4	2019	2021	3	1.33
7	Animesh Lahiri	3	2018	2020	3	1.00
8	Nobuharu Onoda	3	2012	2020	9	0.33
9	Dhvanita R Rao	2	2014	2020	7	0.29
10	Sagnik Chakraborty	2	2019	2021	3	0.67
11	Teruo Asanuma	1	2018	2018	1	1.00
12	Takanori Nagamine	1	2023	2023	1	1.00
13	Sagar Kolte	1	2020	2020	1	1.00
14	Swapnil Lokhande	1	2017	2017	1	1.00

**Table 6:List of communications channels**

Sl. No.	CC	TP	%	CT	%	H-index	CPP	RCI	YFP	YLP	IF	ORG
<b>Journal Articles</b>												
1	J. Algebra (f.1964)	8	17.4	46	13	51	5.75	0.75	2012	2024	0.9	NL
2	J. Pure Appl. Algebra(f.1971)	5	10.9	20	5.66	0	4.00	0.52	2011	2021	0.72	NL
3	Adv. Math. (f.1961)	2	4.35	77	21.8	120	38.50	5.01	2014	2023	1.69	NL
4	J. Algebra Appl. (f.2008)	2	4.35	32	9.07	32	16.00	2.08	2015	2015	0.74	USA
5	J. Commut. Algebra(f.2009)	2	4.35	14	3.97	16	7.00	0.91	2018	2021	0.3	USA
6	Compos. Math. (f.1935)	1	2.17	0	0	61	0	0	2014	2014	1.46	UK
7	Indian J. Pure Appl. Math. (f.1970)	1	2.17	28	7.93	40	28.00	3.65	2015	2015	0.4	India
8	Invent.Math. (f.1966)	1	2.17	97	27.5	118	97.00	12.7	2014	2014	2.95	GRM
9	Nagoya Math.J.(f.1950)	1	2.17	3	0.85	33	3.00	0.39	2020	2020	0.8	UK
10	Not. Am. Math. Soc. (f.1953)	1	2.17	1	0.28	36	1.00	0.13	2023	2023	0.25	USA
11	Trans. Amer. Math. Soc (f.1900)	1	2.17	14	3.97	108	14.00	1.83	2017	2017	1.2	USA
<b>Book Chapter</b>												
12	In: Ambily, A., Hazrat, R., Sury, B. (eds) Leavitt Path Algebra & Classical K-Theory. ISI Series.	1	2.17	0	0	0	0	0	2020	2020		SGP
<b>Conference Paper</b>												
13	Proc. ICM held on 2022 July 6–14; ed. by D. Beliaev and S. Smirnov.	1	2.17	10	2.83	0	0	1.3	2022	2022		GRM
14	Algebra Trans. Gr. MVA, at 6th May 2024	1	2.17	0	0	0	0	0	2024	2024		SJL
15	JMM 2025 held on 8 Jan – 11 Jan in Seattle, WA, USA.	1	2.17	0	0	0	0	0	2025	2025		USA
<b>Preprints</b>												
16	arXiv preprint, e-print ACU	17	37	11	3.12	0	0	0.08	2012	2024		USA
TL		46	100	353	100							

**Table 7: Calculation for Relative Growth Rate (ReGR) and Doubling Time.**

Year	RP	Cum. RP	W1	W2	ReGR	Mean ReGR	Dt = 0.693/ReGR	Mean Dt	% of PG
2011	1	1		0.000	0.000	0.536	0.000	1.200	0
2012	3	4	0.000	1.386	1.386		0.500		200
2013	1	5	1.386	1.609	0.223		3.107		-67
2014	5	10	1.609	2.304	0.695	0.319	0.997	1.217	400
2015	3	13	2.304	2.565	0.261		2.655		-40
2016	0	13	2.565	2.565	0.000		0.000		0
2017	3	16	2.565	2.773	0.208	0.190	3.332	3.823	0
2018	4	20	2.773	2.998	0.225		3.080		25
2019	3	23	2.998	3.135	0.137		5.058		-25
2020	5	28	3.135	3.332	0.197	0.121	3.518	7.104	67
2021	3	31	3.332	3.434	0.102		6.794		-40
2022	2	33	3.434	3.497	0.063		11.000		-33
2023	6	39	3.497	3.664	0.167	0.111	4.149	13.498	200
2024	6	45	3.664	3.807	0.143		4.846		0
2025	1	46	3.807	3.829	0.022		31.500		0

**Table 8: Top 11 highly cited papers and Citation Growth Rate.**

Rank	Title of papers	Communication channels	Citations (TC)	AoP (2024)	CGR = TC/AoP
1	On the cancellation problem for the affine space in characteristic p	Inventiones mathematicae (2014)	97	10	9.7
2	On Zariski's cancellation problem in positive characteristic	Advances in Mathematics (2014)	68	10	6.8
3	On the family of affine three folds	Compositio Mathematica (2014)	35	10	3.5
4	A survey on Zariski cancellation problem	Indian Journal of Pure and Applied Mathematics (2015)	28	9	3.11
5	The epimorphism theorem and its generalizations	Journal of Algebra and its Applications (2015)	17	9	1.89
6	A note on the cancellation property of $k[X, Y]$	Journal of Algebra and its Applications (2015)	15	9	1.6
7	On double Danielewski surfaces and the cancellation problem	Journal of Algebra (2019)	14	5	2.8
8	Some $K$ -theoretic properties of the kernel of a locally nilpotent derivation on $k[X_1, \dots, X_4]$	Transactions of the American Mathematical Society (2017)	14	7	2
9	An algebraic characterization of the affine three space	Journal of Commutative Algebra (2021)	12	3	4
10	On generalised Danielewski and Asanuma varieties	Journal of Algebra (2023)	11	1	11
11	The Zariski cancellation problem and related problems in affine algebraic geometry	Proc. Int. Cong. Math (2022)	10	2	5

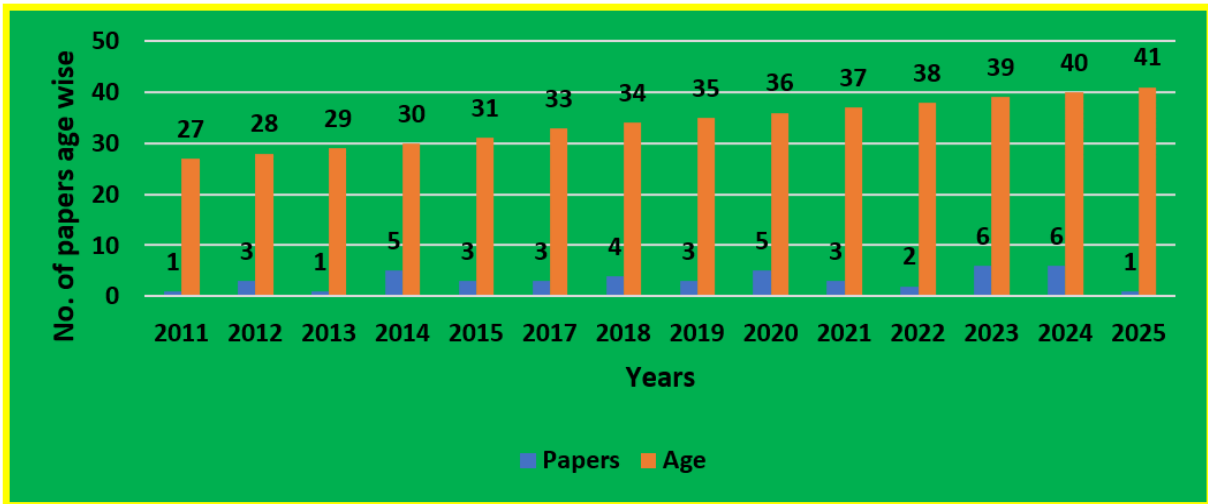


Figure 1: Year and age wise publications of Neena Gupta.

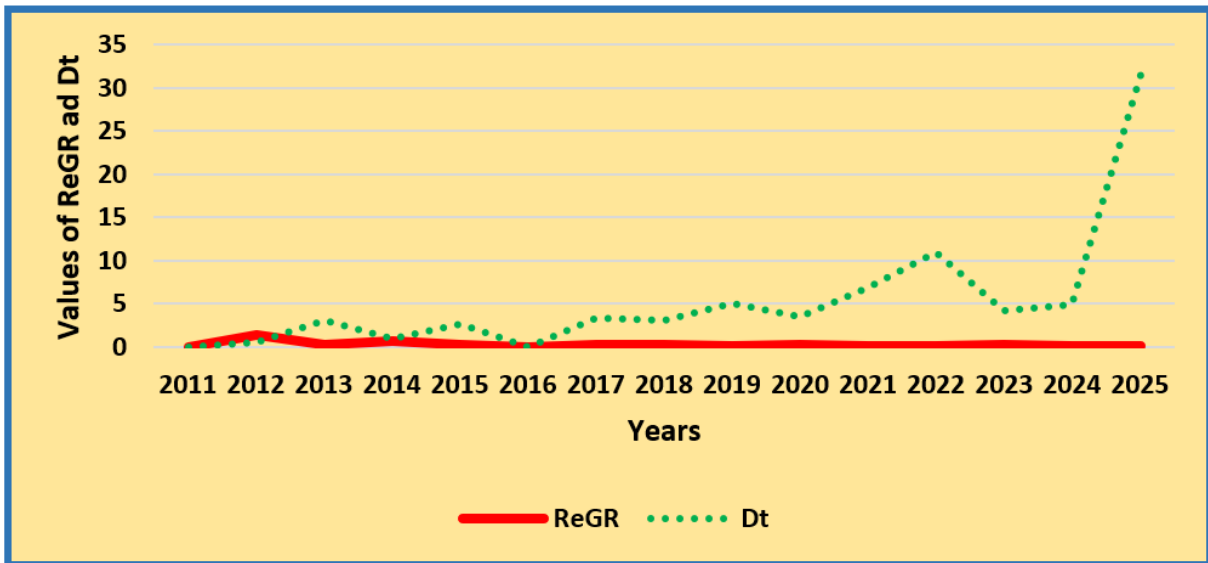


Figure 2: Showing inverse relationship between ReGR and Doubling Time.

**Publication Density (PD)**

PD is the ratio of the total number of papers published to the total number of channels. Here,  $PD = 46/16 = 2.88$ .

**Relative Growth Rate (ReGR) and Doubling Time (Dt)**

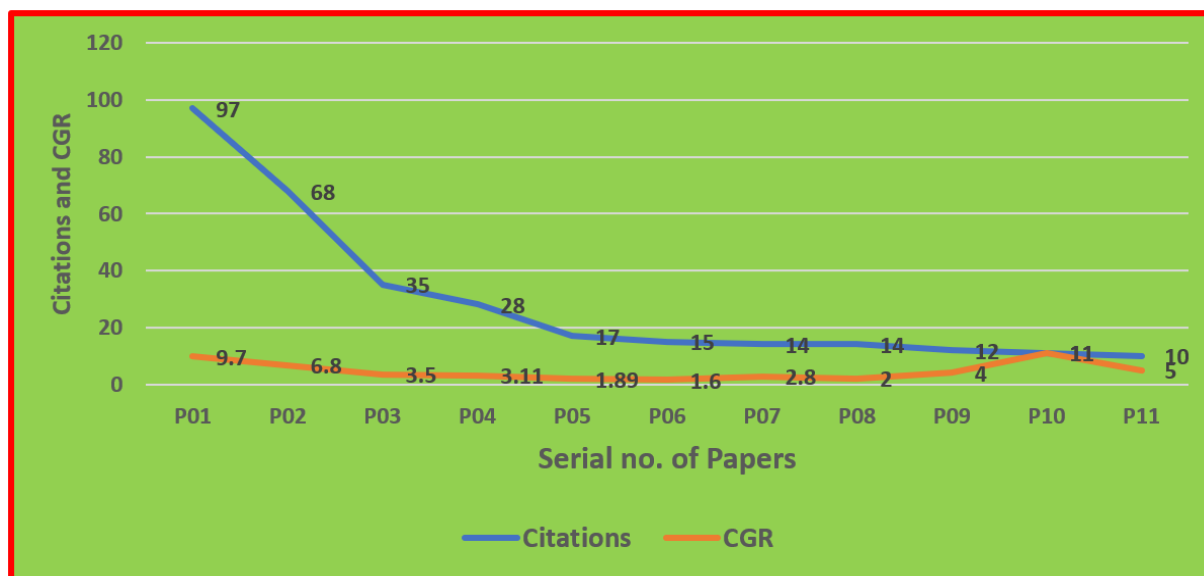
Table 7 outlines the Relative Growth Rate (ReGR), Doubling Time (Dt), and percentage growth in Neena’s publications from 2011 to 2025 (Sawale and Mete, 2021; Jain and Meera., 2022). Figure 2 is showing graphically inverse relationship between ReGR and Dt.

**Top Ranking Scholarly Publications of Dr Neena Gupta**

Table 8 presents the top 11 papers ranked by total citation count and Citation Growth Rate (CGR) (Figure 3). The data highlights that all listed papers have received mega-citations-defined as 10 or more citations-indicating substantial academic impact.

**Discussion**

Dr. Neena’s research shows a clear pattern of early initiation and sustained scholarly growth. Her first research paper was published in 2011, when she was only 27 years old, indicating an early entry into academic research. This early start justifies her recognition as a young researcher and scientist, and her consistent contributions to algebra have earned her the title “Queen of Algebra.” An important indicator of her independent research capability is that 11 of her publications are single-authored, demonstrating strong individual scholarly competence without reliance on collaboration. A chronological analysis of her publications reveals that her highest research output occurred during 2023 and 2024, with a total of six papers, corresponding to the age range of approximately 39 to 45 years. This phase represents the peak of her research productivity, reflecting academic maturity and deep expertise. The second-highest productivity was observed in



**Figure 3:** Graphical representation of Citations and CGR of top cited 11 papers.

2014 and 2020, with five publications each, indicating consistent research engagement across different stages of her career. From a collaboration perspective, the Degree of Collaboration (DC) shows notable results. The highest DC value recorded is 1, indicating complete collaborative research in certain years. The overall DC value of 0.76 suggests that a significant proportion of her research work is collaborative, while still maintaining a substantial level of independent authorship. This balance highlights her ability to contribute both individually and as part of research teams. Overall, the bibliometric indicators reflect Dr. Neena as a productive, influential, and versatile researcher, with strong independent scholarship, increasing research intensity over time, and a healthy collaborative approach-hallmark of an accomplished scientist in the field of algebra.

She has contributed 35 collaborative papers and 11 single single-authored papers during productive career of 15 years. Of them, 21 two-authored papers have published in the time span of 13 years and 12 three-authored papers appeared in the time span of 13 years; only 2 four-authored papers published in the time span of 3 years. From beginning, there was predominance of multi-authored papers during 2011-2025.

The position of researcher in the author by-line has become an important area of study in bibliometric analysis. She is listed as the first author in 08 papers, and as second author in 25 indicating significant intellectual leadership in those works. She is credited as the fourth author in 2 papers only.

Out of a total of 46 publications, 11 papers are single-authored, while the remaining works involve varying degrees of multi-authorship, indicating a balanced mix of individual and collaborative research.

CC values range from 0.00 to 0.63, showing noticeable variation over the years. Years such as 2013 and 2025 recorded a CC value of 0.00, reflecting complete dominance of single-authored publications. In contrast, higher CC values were observed in 2020 (0.63), 2019 and 2021 (0.58 each), and 2018 (0.58), indicating stronger collaborative research during these periods. The overall CC value of 0.43 suggests a moderate level of collaboration in her research output. CI, which measures the average number of authors per paper, varies between 1.00 and 2.80. The lowest CI value of 1.00 in 2013 and 2025 again confirms the presence of single-authored works, while the highest CI value of 2.80 in 2020 reflects the highest level of joint authorship. The overall CI value of 2.11 indicates that, on average, more than two authors contributed to each publication MCC ranges from 0.00 to 0.87, with the highest values recorded in 2019 and 2021 (0.87 each), signifying strong collaborative intensity. The overall MCC value of 0.44 further supports the conclusion that collaboration plays a significant, though not dominant, role in Dr. Neena's research activities. In summary, the data reveal a progressive increase in collaborative research over time, particularly after 2017, while still maintaining a notable contribution of single-authored publications. This pattern highlights Dr. Neena's ability to balance independent scholarships with effective research collaboration, strengthening both the quality and impact of her academic contributions.

*Amartya Kumar Dutta* and *Parnashree Ghosh* are her closest collaborators, each having co-authored 9 papers with her. Next is *Nikhilesh Dasgupta*, with 6 joint publications, followed by *Ananya Pal* with 5. Two other collaborators, *S. M. Bhatwadekar* and *Sourav Sen*, have each co-authored 4 papers with Dr. Neena, placing them in fourth position. *Animesh Lahiri* and *Nobuharu Onoda* have worked with her on 3 papers each, while *Dhvanita*

R. Rao and Sagnik Chakraborty have co-authored 2 papers each. Lastly, three collaborators have published only one paper each with her.

Looking at the time taken to publish, the first co-author (Amartya Kumar Dutta) published 9 papers over 9 years (2012–2020), averaging 1 paper per year. The second co-author (Parnashree Ghosh) published the same number of papers (9) in just 3 years (2022–2024), averaging 3 papers per year. The third collaborator (Nikhilesh Dasgupta) co-authored 6 papers over 5 years, averaging about 1 paper per year. The fourth collaborator (Ananya Pal) published 5 papers in just one year. The trend continues similarly for other collaborators.

The choice of publication venues highlights the high quality and impact of the researcher's work. Out of the 16 journals used, four are particularly notable for their strong academic standing, as reflected in their h-index, Citation Per Paper (CPP), and Relative Citation Impact (RCI): *Advances in Mathematics* (h-index: 120, CPP: 38.50, RCI: 5.01), *Inventiones Mathematicae* (h-index: 118, CPP: 9, RCI: 12.70), *Transactions of the American Mathematical Society* (h-index: 108, CCP: 14, RCI: 1.83), and *Journal of Algebra* (h-index: 51, CPP: 5.75, RCI: 0.75). Additionally, several papers appeared in journals with high impact factors, such as *Inventiones Mathematicae* (IF: 2.95), *Advances in Mathematics* (IF: 1.69), *Compositio Mathematica* (IF: 1.46), and *Transactions of the American Mathematical Society* (IF: 1.20). These publication metrics collectively reflect the researcher's ability to contribute to top-tier journals that maintain rigorous peer-review standards and wide academic influence.

The global reach of the researcher's work is particularly evident, with 45 out of 46 papers published in international journals. The majority of these are based in the USA (24 papers) and the Netherlands (15 papers), with additional contributions appearing in Germany, the UK, Singapore, and Switzerland. Only one paper was published in an Indian journal. This distribution underscores the researcher's strong international visibility and engagement, especially within leading academic networks in the US and Europe.

The ReGR values fluctuate between 0.022 and 1.386, indicating varying publication growth across the years. An inverse relationship between ReGR and Doubling Time is evident—lower growth rates correspond to longer doubling periods, reflecting slower expansion of research output.

Notable publication surges are observed during 2011–2012 and 2013–2014, with growth rates of 200% and 400% respectively, and again during 2022–2023 (200%), suggesting phases of intensified research activity possibly driven by collaborations or new research directions. Block-wise analysis shows a steady rise in mean ReGR over time, culminating in a sharp increase in the final block, indicating enhanced and sustained research productivity. Overall,

the trend reflects early bursts in output followed by a more stable and mature growth pattern in Dr. Gupta's scholarly contributions.

The most cited paper “*On the cancellation problem for the affine space in characteristic  $p$* ”, published 10 years ago, has garnered the highest 97 citations, resulting in a CGR of 9.7. In contrast, the most recent paper, just 1 year old, has already accumulated 11 citations, with a CGR of 11.

Overall, CGR values for these top papers range from 2 to 11, reflecting varying but consistently strong citation momentum. A higher CGR suggests a faster rate of influence relative to the paper's age. This trend demonstrates not only sustained interest in the author's earlier works but also a promising citation trajectory for her more recent publications.

## CONCLUSION

This bibliometric analysis of Dr. Neena Gupta's scholarly output from 2011 to 2025 provides a clear, data-supported picture of her sustained and high-impact contribution to mathematical sciences. Based on 46 publications collected from ResearchGate, Google Scholar, and official sources, the study demonstrates both the depth and consistency of her research career over a 15-year period. Her work is characterized by a strong presence in internationally reputed journals, notably the *Journal of Algebra* and the *Journal of Pure and Applied Algebra*, underscoring the global relevance and quality of her research.

Dr. Gupta's authorship pattern reveals a balanced research profile, with 11 single-authored papers reflecting independent scholarships and 8 first-authored collaborative works highlighting leadership in joint research. Her collaboration network is well-defined, particularly with Amartya Kumar Dutta and Parnashree Ghosh, each contributing to nine co-authored papers, indicating long-term, productive research partnerships. The calculated bibliometric indicators—Degree of Collaboration (0.76), Collaboration Coefficient (0.43), Collaboration Index (2.11), and Modified Collaboration Coefficient (0.44)—collectively point to a healthy mix of solo and collaborative research activity.

Productivity trends show a steady rise, with peak publication output in 2023 and 2024 (six papers each year), reflecting continued research momentum well into the later stages of the study period. Growth indicators such as the Relative Growth Rate (ReGR) and its inverse relationship with Doubling Time further confirm a dynamic and expanding research trajectory.

Citation analysis highlights the significant scholarly impact of her work. Her landmark 2014 paper—linked to her solution of a version of the Zariski Cancellation Problem in positive characteristic—has received 97 citations, while her most recent paper has already accrued 11 citations within a year, indicating immediate relevance and visibility. These citation patterns demonstrate both long-term influence and current research vitality.

In summary, the bibliometric evidence firmly establishes Dr. Neena Gupta of ISI Kolkata as a leading mathematician of her generation. Her internationally acclaimed solution to a decades-old problem, combined with strong publication metrics, impactful collaborations, and prestigious recognition such as the Infosys Prize in Mathematical Sciences (2024), positions her as an influential figure in modern algebraic geometry. Beyond quantitative measures, her career serves as a powerful source of inspiration—particularly for women in STEM—and exemplifies how sustained excellence, originality, and collaboration contribute to lasting scientific impact.

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## ABBREVIATIONS

**TP:** Total papers; **CP:** Cumulative papers; **AA:** Author's biological age; **PPA:** Paper productive age; **SAP:** Single Authored Papers; **MAP:** Multi-Authored Papers; **CoA:** Co-authors; **DC:** Degree of Collaboration; **FPA:** Fifty Percentile Articles; **SJL:** Switzerland; **GRM:** Germany; **SGP:** Singapore; **NL:** Netherlands; **ORG:** Origin; **CT:** Citation; **CPP:** Citation per paper; **RCI:** Relative Cited Index; **IF:** Impact Factor; **RP:** Research Paper; **Cum.RP:** Cumulative Research Paper; **PG:** Publication Growth; **TC:** Total Citations; **AoP:** Age of Paper; **Ca.:** Approximately; **ISI:** Indian Statistical Institute; **RG:** ResearchGate; **GS:** Google Scholar; **CGR:** Citation Growth Rate; **ReGR:** Relative Growth Rate; **Dt:** Doubling Time; **STEM:** Science, Technology, Engineering, and Mathematics; **TIFR:** Tata Institute of Fundamental Research; **SPMF:** Shyama Prasad Mukherjee Fellowship; **CSIR:** Council of Scientific and Industrial Research; **JMM:** Joint Mathematics Meetings; **PBC:** Publication Concentration; **PD:** Publication Density; **TL:** Total; **J. Algebra:** Journal of Algebra; **J. Pure Appl. Algebra:** Journal of Pure and Applied Algebra; **Adv. Math:** Advances in Mathematics; **J. Algebra Appl.:** Journal of Algebra and its Applications; **J. Commut. Algebra:** Journal of Commutative Algebra; **Compos. Math.:** Compositio Mathematica; **Indian J. Pure Appl. Math.:** Indian Journal of Pure and Applied Mathematics; **Invent. Math.:** Inventiones Mathematicae; **Nagoya Math. J.:** Nagoya Mathematical Journal; **Not. Am. Math. Soc.:** Notices of The American Mathematical Society; **Trans. Amer. Math. Soc.:** Transactions of the American Mathematical Society; **Proc. ICM:** Proceedings of International Congress of Mathematicians; **Algebra Trans.Gr. MVA:** Algebraic Transformation Groups Monte Verit'a Ascona; **JMM 2025:** 2025 Joint Mathematics Meetings; **CC =** Communication Channels; **ACU =** Archive Cornell University.

## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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## AUTHOR CONTRIBUTIONS

Dr. Koley conceived and supervised the study and provided critical revisions. Ms. Sutapa collected data, analyzed and tabulated the data, and prepared the initial draft of the manuscript. Both authors reviewed and approved the final manuscript.

## SUMMARY

Dr. Neena Gupta, a distinguished mathematician from the Indian Statistical Institute (ISI), Kolkata, has emerged as a leading figure in contemporary mathematics. Best known for her groundbreaking solution to the Zariski Cancellation Problem in positive characteristic in 2014, she has been internationally acclaimed and was awarded the Infosys Prize in Mathematical Sciences in 2024. Between 2011 and 2025, Dr. Gupta authored 46 research papers, including 11 single-authored works and 8 first-author collaborative papers. Her work primarily appears in reputed international journals, with the Journal of Algebra and Journal of Pure and Applied Algebra publishing the highest number of her papers. Her closest collaborators are Amartya Kumar Dutta and Parnashree Ghosh. This bibliometric study, based on data from ResearchGate, Google Scholar, and her official website, provides a quantitative analysis of her research output. Key indicators such as DC (0.76), CC (0.43), CI (2.11), and MCC (0.44), along with metrics like publication concentration, density, growth rate, and citation impact, reflect the depth and influence of her scholarly contributions. Her most cited work has received 97 citations, while even her recent papers show strong citation performance. Dr. Gupta's academic excellence and pioneering research continue to inspire, particularly encouraging young women in STEM fields.

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