

From Earth to the Stars: A Bio-Bibliographic Tribute to the Inspiring Legacy of Bibha Chowdhuri

Susanta Koley^{1,*}, Sutapa Goswami²

¹Librarian, Central Library, Durgapur Institute of Advanced Technology and Management, G T Road, Rajbandh, Durgapur, Paschim Bardhaman, West Bengal, INDIA.

²Assistant Librarian, Durgapur Institute of Polytechnic, G T Road, Rajbandh, Durgapur, Pashchim Bardhaman, West Bengal, INDIA.

ABSTRACT

Aim: The paper offers a bibliometric narrative of Bibha Chowdhuri's impactful research in cosmic ray studies and reflects on her recognition through the astronomical naming of a yellow-white star, 'Bibha', as a tribute to her scientific achievements. **Background:** Dr. Bibha Chowdhuri, a pioneering physicist in cosmic ray research, was posthumously recognized 28 years after her death. This study outlines her life and analyses 28 of her research contributions made between 1939 and 1990. Though her work paralleled that of Nobel laureates P.M.S. Blackett (1948) and Cecil Powell (1950), Bibha's efforts remained largely unrecognized and uncredited during lifetime. Powell, however, acknowledged the early contributions of Bibha and D.M. Bose in his published citations, recognizing their pioneering efforts. **Methodology:** Due to inadequate documentation and limited digital archiving, many of Dr. Bibha Chowdhuri's publications and citations are not readily accessible through conventional academic platforms such as ResearchGate or Google Scholar. Consequently, her research contributions were reconstructed using references found in the works of other scholars, her incomplete curriculum vitae, and information from various online sources. Standard bibliometric methodologies were employed to develop a scientometric profile of Dr. Chowdhuri's scholarly output in the fields of Cosmology and Astroparticle Physics. **Findings:** Of the 28 publications attributed to Dr. Bibha Chowdhuri, 8 are single-authored, while 20 are collaborative works, resulting in a Degree of Collaboration (DC) of 0.71. Her most productive year was 1944, during which she published 4 papers at the age of 31. Remarkably, 18 of her 28 publications (64%) were produced after the age of 50, demonstrating sustained scientific engagement well into later life. Among her key collaborators were D. M. Bose and A. K. Ganguly, who worked with her for 5 and 8 years, respectively. The majority of her works were published as journal articles, with the highest number-4 articles-appearing in the UK-based journal Nature, which holds a current h-index of 1442. Furthermore, an analysis of keyword frequency reveals that the top three terms consistently represent the central themes of her research and highlight the areas for which she is most recognized. **Conclusion:** Despite facing gender-based and geopolitical challenges, Dr. Bibha Chowdhuri's scientific contributions and the recognition of the star named in her honour have secured her a distinguished place in the history of science. Though Indian by nationality, she emerged as a luminous figure in global scientific discourse and continues to inspire women in science today.

Keywords: Bibha Chowdhuri, India's First Female Particle Physicist, Bibliometric Study.

Correspondence:

Dr. Susanta Koley

Librarian, Central Library, Durgapur
Institute of Advanced Technology and
Management, G T Road, Rajbandh,
Durgapur, Paschim Bardhaman,
West Bengal, INDIA.
Email: shayanikoley.2013@gmail.com

Received: 09-04-2025;

Revised: 13-06-2025;

Accepted: 28-08-2025.

INTRODUCTION

Dr. Bibha Chowdhuri, a trailblazing Bengali physicist, epitomizes brilliance in Indian scientific history. Her name, "Bibha," meaning "a radiant beam of light" in Bengali, aptly symbolizes the illuminating influence she has had on the field of science. This study aims to explore her life and scientific contributions through a scientometric perspective, emphasizing the critical

importance of acknowledging the achievements of women in science. This narrative begins with Bibha Chowdhuri, India's first female particle physicist and renowned for her ground-breakings research on cosmic rays. Collaborating with Debendra Mohan Bose (D.M. Bose), she pioneered the use of photographic nuclear emulsions to become the first scientist to detect and identify mesons. In recognition of her remarkable legacy, the International Astronomical Union (IAU) named the star *HD 86081* as 'Bibha' in her honour (Wikipedia, 2025).

Bio-bibliometric Study

Bio-bibliometric study refers to the application of mathematical and statistical techniques to analyse the biography and



ScienScript

DOI: 10.5530/irc.2.1.15

Copyright Information :

Copyright Author (s) 2025 Distributed under
Creative Commons CC-BY 4.0

Publishing Partner : ScienScript Digital, [www.scienscript.com.sg]

bibliographical data of individuals like authors, scientists, artists, singers, or various professionals, whether living or deceased. This approach is also commonly known by terms like bibliometrics, scientometrics, and informetric. Various bibliometric indicators are used to evaluate and highlight the significance of a person's contributions within a particular field. Globally, this research area is recognized as bibliometric research and is a key discipline within Library and Information Science (LIS). Such studies are likely to increase the visibility of a good scientist, who is otherwise less known.

Particle Physics

Particle physics, also known as high-energy physics, is the branch of physics that studies the fundamental constituents of matter and radiation, and the interactions between them. It delves into the smallest building blocks of the universe, exploring particles like quarks, leptons, and bosons, and the forces that govern their behaviour. Simply, particle physics is the study of the smallest pieces of matter and the forces that hold them together. It explores what everything in the universe is made of at the tiniest level.

Early Life and Her Family

Dr. Bibha Chowdhuri was born on 3 July 1913 in Kolkata, into a progressive zamindar family from Bhandarhati in Dhaniakhali Block in Hooghly district, West Bengal. She was the daughter of Dr. Banku Behari Chowdhuri, a practicing physician at Mayo Hospital in Kolkata, and Urmila Devi, a member of the reformist Brahmo Samaj and a relative of the eminent scientist Sir Jagadish Chandra Bose. Interestingly, Mayo Hospital had also been the work place of Nil Ratan Sircar, who served there as a house surgeon in 1888-89. Bibha was the third of five siblings-the only brother being the youngest. The family, deeply influenced by Brahmo ideals, strongly believed in equal education for both sons and daughters, a rare stance at the time. This belief laid the foundation for a highly educated and accomplished family. Her eldest sister, Roma Chowdhuri, became a teacher at the Brahmo Balika Shikshalaya (Brahmo Girls' School) in Kolkata. The second sister passed away at a young age. Leela Chaudhuri, the fourth sibling, initially worked for the Tea Board in Kolkata before traveling to England for Montessori training. She later served as the Principal of Jadavpur Vidyapith (Junior Section). The youngest sister, Uma Chaudhuri, completed her postgraduate studies in psychology at Calcutta University and went on to earn a Ph.D. in social psychology in the USA. Upon returning to India, she joined the West Bengal Government's Health Department, focusing on the social dynamics of indigenous groups such as the Jarwas of the Andaman Islands and the Santhals. Their youngest sibling and only brother, Ranjit Chaudhuri, earned an engineering degree from Jadavpur University and later worked as a Sales Manager at English Electric. It is not a mere speculation that the entire family of Bibha was well-educated due to the influence of Brahmo Samaj. Bibha's extended family was also

distinguished. Her mother Urmila's elder sister, Nirmala Devi, was married to Sir Nilratan Sircar (1861-1943), a pioneering physician after whom the Nil Ratan Sircar Medical College and Hospital is named. Nilratan's daughter, Nalini, married Debendra Mohan Bose, a noted physicist who later became Director of the Bose Institute following the death of Sir Jagadish Chandra Bose. This made D.M. Bose Bibha's cousin-in-law, as his mother-in-law and Bibha's mother were sisters. Reflecting their family values, none of the siblings, including Bibha herself, ever married. Their lives were marked by a strong commitment to education and public service, shaped by the reformist ideals of the Brahmo Samaj (Wikipedia, 2025; Mondal, 2023; Roy and Singh, 2018).

Education

Dr. Bibha Chowdhuri Completed School (matriculation) in 1928 from Bethune School (f. 1849) in Kolkata, one of the oldest girls' schools in India as well as Asia. She pursued I.Sc. (Intermediate Science) at Scottish Church College (f. 1830) in Calcutta in 1930 (1928-1930 batch). After that, she obtained B.Sc. degree with Honours in Physics from the same college of the University of Calcutta in 1932 (i.e. 1930-1932 batch) wherein Swami Vivekananda, Netaji Subhas Chandra Bose and many more celebrated persons studied. She received M.Sc. degree in Physics under Professor D.M. Bose at University of Calcutta in 1936 (i.e. 1934-36 batch). She was the only girl student in the class of the batch having 24 students. She was the 3rd woman to receive a post graduate degree in physics from Calcutta University even after 20 years of the beginning of post graduate studies in Calcutta University. After completing her M.Sc. degree, she initially joined Calcutta University as a teaching faculty and then started research works in physics under the guidance of D.M. Bose, then Palit Professor of Physics of the University (Mondal, 2023; Roy and Singh, 2018).

Professional and Research Journey

Following the completion of her M.Sc. degree, Bibha Chowdhuri began her professional and research career at the Bose Institute in Kolkata. Her journey can be chronologically divided into the following distinct phases.

Early Research at Bose Institute: 1936-1942

In 1936, Bibha Chowdhuri approached Prof. D.M. Bose (1905-1971), then the Palit Professor of Physics at Calcutta University, with the intention of joining his research group to pursue studies in physics. By 1938, she became associated with the Bose Institute under his guidance, where she began work on detecting mesons using photographic emulsions and cloud chambers. Together, they utilized high-altitude photographic nuclear emulsions from Himalayan expeditions to study mesotron showers-an early indication of the presence of mesons (Wikipedia, 2025). Her first research publication, titled "*Studies in Nuclear Disintegration by the Photographic Plate Method-I:*

Disintegration of Samarium Nucleus by *Cosmic Rays*”, appeared in the *Transactions of the Bose Research Institute* in 1939 (Roy and Singh, 2021). As a co-author, Chowdhury contributed to several significant papers published in *Nature* between 1940 and 1942, which reported the discovery and mass estimation of pi-mesons (pions) and mu-mesons (muons). However, the outbreak of World War II disrupted the supply of high-sensitivity emulsion plates, impeding further progress in their pioneering research.

PhD at University of Manchester: 1936-1942 and 1952

In 1945, Bibha Chowdhury moved to Manchester to work in the laboratory of Sir Patrick Blackett, where she investigated extensive air showers using cloud chambers and Geiger-Müller counters. She submitted her doctoral thesis, titled “*Extensive Air Showers Associated with Penetrating Particles*,” in 1949. Her work impressed her examiner, physicist Lajos Jánossy, who subsequently recommended her to Dr. Homi Bhabha. She was awarded her Ph.D. in 1952. While Blackett received the Nobel Prize in Physics in 1948 for related work, Bibha’s scientific contributions, though acknowledged, were not formally credited. Similarly, Cecil Powell, who was awarded the Nobel Prize in 1950 for research in the same field, recognized the pioneering efforts of Bibha Chowdhury and D.M. Bose in his citations (Wikipedia, 2025; Bhowal, 2022; Roy and Singh, 2021; Bhattacharya, 2018).

Tata Institute of Fundamental Research (TIFR) and International: 1949-1954

Dr. Bibha returned to India in 1949 and became the first female researcher to work at the prestigious TIFR. Dr Homi J. Bhabha recruited her since he was working on cosmic rays too. She Led the Cloud Chamber Group, identifying various Kmesons using nuclear emulsion stacks. She participated in the 2nd International Conference on Elementary Particles (Pisa, Italy, 1955) from TIFR. In 1954, Bibha took a visiting researcher position at University of Michigan and spent 1953-57 in Paris at École Polytechnique, utilizing multiplate cloud chambers in the Alps (Wikipedia, 2025; Kautilya, 2018; Roy and Singh, 2021).

Physical Research Laboratory (PRL) and Kolar Gold Fields: 1954-early 1970s

Bibha Chowdhury later joined the Physical Research Laboratory (PRL) in Ahmedabad, working under the leadership of Dr. Vikram Sarabhai. At PRL, she made significant contributions to cosmic-ray research and participated in the Kolar Gold Field (KGF) experiments, focusing on the study of high-energy muons. She also proposed an innovative radio-frequency cosmic-ray detection experiment to be conducted at Mount Abu; however, the project was shelved following Sarabhai’s sudden passing in 1971. Eventually, Bibha chose to take voluntary retirement from PRL and returned to Kolkata (Kautilya, 2018; Wikipedia, 2025).

Later Years and Saha Institute of Nuclear Physics: 1970s-1990

Following her retirement from PRL, Bibha Chowdhuri returned to Calcutta, where she remained actively engaged in high-energy physics research. She collaborated with scientists from institutions such as Calcutta University, the Saha Institute of Nuclear Physics (SINP), the Variable Energy Cyclotron Centre (VECC), and the Indian Association for the Cultivation of Science (IACS). Her work primarily involved the use of solid-state nuclear track detectors, such as CR-39, for particle detection. Remarkably, she continued publishing scientific research until the end of her life, with her final paper appearing in 1990 (Kautilya, 2018; Wikipedia, 2025; Roy and Singh, 2018).

Unrecognized Bibha

One of the most significant chapters in Chowdhury’s career was her involvement in the *Kolar Gold Field* (KGF) experiments in Karnataka, India. Yet, as the KGF experiments lost funding and were eventually abandoned in the 1980s, so too was much of the record of her contributions. While other scientists associated with KGF went on to receive national awards and international recognition, Bibha Chowdhury’s role was largely overlooked, her name mentioned only in acknowledgments or “special thanks” in colleagues’ publications (San Diego2, n.d.). Two prominent physicists who received the *Nobel Prize* for work related to cosmic rays and particle detection were *Patrick M.S. Blackett* (1948) and Cecil Powell (1950). Both were British physicists whose experiments benefited from techniques pioneered by Indian scientists like D.M. Bose and Bibha Chowdhury. Despite these acknowledgments, Bibha Chowdhury was not formally credited or nominated for major awards, partly due to the colonial bias in science and the marginalization of women scientists (Bhowal, 2022; Roy and Singh, 2021; Bhattacharya, 2018). Several systemic and contextual factors contributed to the erasure or neglect of Bibha Chowdhury’s scientific legacy (San Diego2, n.d.; Roy and Singh, 2018):

1. **Gender Bias:** As a woman in physics in pre- and post-independence India, she faced immense barriers in visibility, funding, and institutional support.
2. **Colonial Overshadowing:** Indian science under British rule was often seen as peripheral; thus, even groundbreaking work by Indian scientists failed to receive international attention.
3. **Archival Neglect:** A lack of proper documentation, citations, and promotion from Indian institutions meant her contributions faded from official records.
4. **Scientific Politics:** Many of her male colleagues rose through bureaucratic and academic ranks that rewarded visibility and networking-resources Bibha may not have had access to.

Legacy and Posthumous Recognition

In recognition of her contributions to science, the International Astronomical Union named a star "Bibha" in 2019—a white-yellow dwarf located approximately 340 light-years away in the constellation Sextans. A year earlier, in 2018, her life and work were brought to wider public attention through the publication of a biography titled "A Jewel Unearthed: Bibha Chowdhuri - The Story of an Indian Woman Scientist" by Suprakash C. Roy and Rajinder Singh. Further honouring her legacy, the Ministry of Women and Child Development, Government of India instituted a Professorship in Physics (i.e. Physics Chair) in her name in 2020. She is now remembered as India's first woman particle physicist, though during her lifetime she remained relatively unrecognized outside scientific circles (Wikipedia, 2025; Roy and Singh, 2021; Kautilya, 2018).

Objectives

The main objectives of this study are:

- a) To find year wise publications of Dr. Bibha with authorship pattern,
- b) To observe his position as main author and co-author,
- c) To calculate the degree of collaboration,
- d) To measure author productivity,
- e) To identify age wise publication pattern,
- f) To find the research team with co-authors,
- g) To identify the preferred journals,
- h) To analyse citation received or 'cited by'.

METHODOLOGY

This study includes 28 publications by Dr. Bibha Chowdhuri, spanning the years 1939 to 1990. Due to lack of proper documentation of her publications, her papers were not available through databases like ResearchGate or Google Scholar, etc. Instead, the publications were gathered from references in other authors' works, her incomplete CV, and various websites. Additional information was collected from both online and offline sources. A complete bibliography was compiled for this study, consisting of 25 journal articles, 1 conference paper, 1 book chapter, and 1 dissertation, published in India and abroad. All collected data were organized and entered into MS Excel and Word for analysis, following the study's objectives. The findings are presented and discussed in the sections that follow.

Review of Literature

Over the past few decades, numerous bio-bibliometric and scientometric studies have been carried out by librarians and information scientists to evaluate the research productivity, impact, and biographical profiles of prominent scientists and

scholars across diverse disciplines. Below is a chronological summary of some key contributions in this area:

Varaprasad *et al.*, (2010) conducted a bibliometric analysis of J. S. Yadav's work in chemical sciences. That same year, Sangam and Savanur (2010) examined the scholarly legacy of Eugene Garfield, a foundational figure in bibliometrics and scientometrics. Mukherjee (2013) assessed the research output of Prof. Lalit Singh, while Manjunath and Ramesha (2015) explored the life and contributions of Nobel Laureate Sir C. V. Raman. Koley and Sen (2016, 2017) analysed the academic contributions of V. L. Kalyane—an early leader in bio-bibliometrics—and produced a scientometric profile of renowned astronomer Jan Hendrik Oort. Mondal *et al.*, (2018) compiled a bio-bibliometric account of Prof. P. C. Mahalanobis, a pioneering Indian statistician. Dutta (2019) evaluated the work of information scientist Prof. B. K. Sen, while Yasmin (2019) studied the research output of Prof. Kasi Pitchumani in chemistry. Teli and Maity (2021) performed a bibliometric analysis of physicist Stephen Hawking's scientific publications, and Hussain and Shakoor (2022) focused on Dr. Saeed Ullah Jan's contributions to Library and Information Science. More recently, Shivaraja O (2023) assessed the research productivity of Prof. K. R. Venugopal in electronics and computer science. Huded *et al.*, (2023) offered a statistical evaluation of ecologist Prof. Madhav Gadgil's work. Koley (2023, 2024) conducted scientometric studies on Prof. Subhas Mukherjee, the pioneer behind India's first IVF baby, and Prof. Dilip Mahalanobis, known for developing Oral Rehydration Solution (ORS). Behera and Meher (2024) analyzed the economic research of Dr. Raghuram Rajan, former RBI Governor, while Kavi and Singh (2024) studied aerospace scientist Poddam Narasimha. Most recently, Koley (2025) published a bio-bibliographic study on Dr. Suprabhat Mukherjee, a colon cancer researcher. In parallel, outside the formal library and information science domain, several independent authors have documented the life and legacy of Dr. Bibha Chowdhuri. Roy and Singh (2018, 2021) wrote a detailed biography and several key articles on her scientific journey. Saxena (2021) offered reflections on her work and legacy, while Gupta (2021) highlighted her lasting impact. More recently, Mondal (2023) provided a thoughtful account of her scientific achievements. Despite a dedicated scientometric or bibliometric evaluation of Dr. Bibha's research contributions has not yet been conducted. This study seeks to fill that gap by presenting a comprehensive bibliometric analysis of Dr. Bibha's work, particularly in the field of Astroparticle Physics.

RESULTS AND DISCUSSION

Authorship Scenario

Table 1 presents the distribution of the author's publications by year and age, along with the number of co-authors and the collaboration coefficient. Out of a total of 28 papers, the author has 8 single-authored papers and 20 co-authored papers to her

credit. She has contributed as the first author in 7 papers, 2nd author in 10, 3rd author in 2, and 7th author in 1. Overall, she has co-authored 13 papers. Interestingly, the highest number of contributions i.e. 10 papers were made as the 2nd author, followed by 7 papers as the 1st author. The author's first paper was published at the age of 26, marking the beginning of a research career that spanned 51 years. However, there are several years during which no publications were found, including 1943, 1945-1947, 1951, 1953-1955, 1957-1970, 1972, 1974, 1976, 1978-1982, 1984, and 1986. It causes due to lack of proper documentation so far. Her most productive year was 1944, when she published 4 papers at the age of 31. Notably, 18 of her 28 papers (64%) were published after the age of 50. By the time she turned 60, over 76% of her work had already been published. She remained active in research even after retirement, contributing 9 papers during this period. Her final paper was published in 1990, just a year before her passing in 1991. A graphical representation of Figure 1 shows year wise distributions of Bibha's contribution during 1939- 1990.

Productivity Co-efficient (PC)

$PC = FPA / \text{total PPA}$. As she published 50% of the total papers 28 i.e. 14 by the end of the year 1950, her FPA age is 37. $PPA = 77$. Here, $PC = 37/77 = 0.48$.

Authorship Pattern

The authorship pattern, as shown in Table 2, highlights the number of authors per publication. It is evident that the author produced only 8 single-authored papers throughout her entire research career, while the remaining publications were collaborative in nature. Among the collaborative works, 10 papers involved two authors, 6 were co-authored by three individuals, 2 by five, 1 by seven, and 1 by nine authors. In the early phase of her career, single-authored papers were predominant. Over time, multi-authored papers began to appear, continuing until 1990. The two-author collaborations account for the largest share, comprising 10 papers, or approximately 36% of the total output. The two-, three-, and five-author collaborations were spread over a time span of 32 to 44 years, indicating sustained collaborative engagement. In contrast, the eight single-authored papers were published within a much shorter period of 12 years.

Table 1: Year- and -age wise distribution of publications.

Year	TP	CP	AA (b.1913)	PPA	SAP	MAP	Authorship Status				CoA	DC= MAP/TP
							1 st	2 nd	3 rd	7 th		
1939	1	1	26	1	1							
1940	1	2	27	2		1		1			1	1.00
1941	2	4	28	3		2		2			2	1.00
1942	2	6	29	4	1	1		1			1	0.50
1944	4	10	31	6	2	2		2			3	0.50
1948	1	11	35	10	1							0.00
1949	2	13	36	11	2							0.00
1950	1	14	37	12	1							0.00
1952	2	16	39	14		2	2				4	1.00
1956	1	17	43	18		1			1		4	1.00
1971	1	18	58	33		1	1				1	1.00
1973	1	19	60	35		1	1				1	1.00
1975	1	20	62	37		1	1				1	1.00
1977	1	21	64	39		1	1				1	1.00
1983	1	22	70	45		1	1				1	1.00
1985	1	23	72	47		1		1			2	1.00
1987	2	25	74	49		2		2			6	1.00
1988	1	26	75	50		1			1		2	1.00
1989	1	27	76	51		1				1	8	1.00
1990	1	28	77	52		1		1			6	1.00
Total	28				8	20	7	10	2	1	44	0.71

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. The position of a researcher in the author byline has become an important area of study in bibliometric analysis. Table 3 presents the authorship positions held by Bibha in her collaborative publications. She is listed as the first author in 7 papers, indicating significant intellectual leadership in those works. In 10 papers, she appears as the 2nd author, while she is credited as the 3rd author in 2 papers. Notably, she appears in the 7th position in only one publication.

Research Team

Table 4 illustrates the research collaboration network of Bibha and highlights the extent of her academic partnerships. Over the course of her productive career, she collaborated with a total of 20 researchers. Among them, Bibha Chowdhuri emerged as her most frequent collaborator, co-authoring 6 papers. D. M. Bose and A. K. Ganguly were also prominent collaborators, working with her for durations of 5 and 8 years respectively. Y. C. Saxena co-authored 4 papers with Bibha over a period of 7 years. In addition, there are three collaborators with whom she published 3 papers each. Another group of five co-authors contributed to 2 papers each in collaboration with her. Lastly, there is a set of nine collaborators, each of whom co-authored a single paper with her.

Main Author's and Co-author's Names

Table 5 lists the names of first authors and co-authors associated with Bibha's publications. It shows that *D. M. Bose*, *Bibha Chowdhuri*, and *A. Ganguly* frequently served as first authors within her research team. In total, her collaborative work involved 44 different co-authors, reflecting the broad and diverse nature of her academic network.

Communication Channels

Table 6 presents a ranked list of the communication channels in which Bibha published her research. Nearly 89% of her papers appeared in serial publications, primarily peer-reviewed journals. Her most frequently used journal was *Nature* (established in 1869, UK), which published 5 of her papers-accounting for approximately 17.87% of her total output. This is followed by 4 papers (14.29%) published in the *Proceedings of the Indian Academy of Sciences, Section A* (established in 1930, India). Additionally, there is a group of three journals in which she published 3 papers each. Another notable journal in her publication record is *Pramana: Journal of Physics* (established in 1973), which featured 2 of her papers. She also published one paper each in five other journals. In terms of journal impact, *Nature* holds the highest *h*-index of 1442, followed by *Physical Review* (est. 1893) with an *h*-index of 700, and the *Proceedings of the Royal Society of London* (Est. 1831) with an *h*-index of 144.

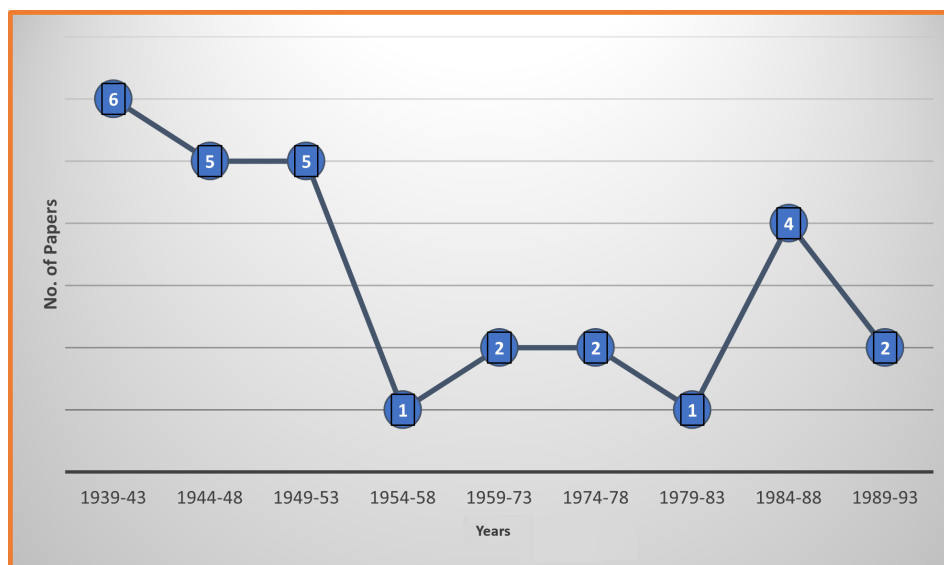


Figure 1: Yearwise distributions of Bibha's papers.

Table 2: Authorship Pattern and Time Span.

Number of authors	Single	Two	Three	Five	Seven	Nine
Non-collaborative papers	8					
Collaborative papers		10	6	2	1	1
Time span (Total)	12	44	44	32	1	1
Year-range	1939-50	1940-83	1994-87	1956-87	1990	1989

Table 3: By-line position of Bibha.

Authorship pattern	Positions in byline of Bibha				
	1 st	2 nd	3 rd	7 th	Total
Two-authored	5	5			10
Three-authored	2	3	1		6
Five-authored		1	1		2
Seven-authored		1			1
Nine-authored				1	1
Total	7	10	2	1	20

Table 4: List of Co-authors and Publications.

Sl. No.	Co-authors name	Papers	YFP	YLP	Year taken	Paper/Year
1	Bose, D. M.	6	1940	1944	5	1.2
2	Ganguly, A.K.	6	1983	1990	8	0.75
3	Saxena, Y.C.	4	1971	1977	7	0.57
4	Baliga, B.B.	3	1985	1987	3	1.00
5	Bhattacharyya, Deba P.	3	1988	1990	3	1.00
6	Pal, Pratibha,	3	1988	1990	3	1.00
7	Basu, Basudhara	2	1989	1990	2	1.00
8	Mukherjee, S. C.	2	1989	1990	2	1.00
9	Rakshit, Ruma	2	1989	1990	2	1.00
10	Saxena, R. C.	2	1952	1952	1	2.00
11	Subramanian, A.	2	1952	1952	1	2.00
12	Becker, J.	1	1956	1956	1	1.00
13	Biswas, S.	1	1989	1989	1	1.00
14	Chanson P.	1	1956	1956	1	1.00
15	Courant, H.	1	1956	1956	1	1.00
16	Durgaprasad, N.	1	1989	1989	1	1.00
17	Mitra, B.	1	1987	1987	1	1.00
18	Sen, S.	1	1987	1987	1	1.00
19	Sinha, M.	1	1944	1944	1	1.00
20	Treille, B.	1	1956	1956	1	1.00

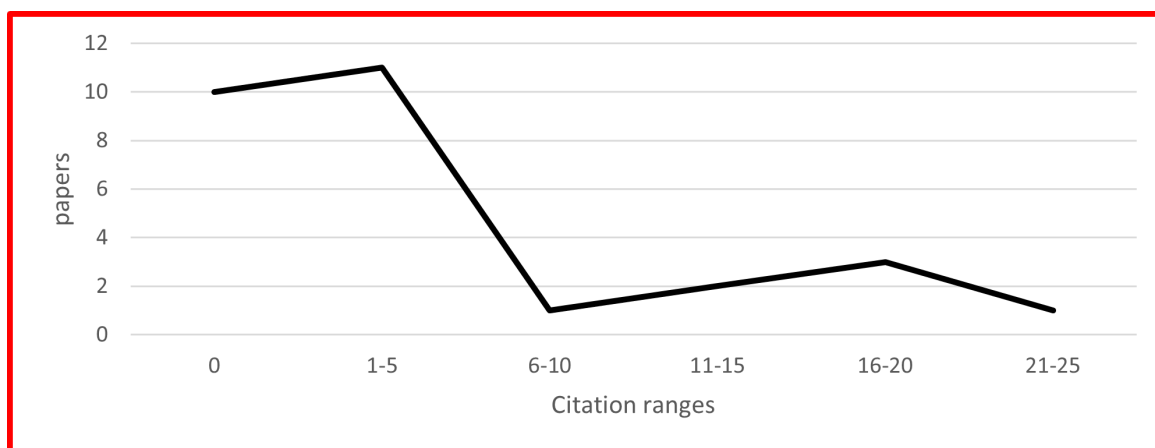
**Figure 2: Citation received of Bibha's papers.**

Table 5: List of first author's and co-author's names.

Year	Main author/ 1 st Author's names	Co-author's name
1940	Bose, D.M.	Chowdhry, Biva
1941	Bose, D.M.; Chowdhey, Biva	Chowdhey, Biva
1942	Bose, D.M.	Choudhuri, Bibha
1944	Bose, D.M.	Choudhuri, Bibha; Sinha, M.
1952	Chowdhuri, B.	Saxena, R.C.; Subramanian, A.
1956	Becker, J.	Chanson P; Chowdhuri, B.; Courant, H.; Treille, B.
1971	Chowdhuri, B.	Saxena, Y.C.
1973	Chowdhuri, B.	Saxena, Y.C.
1975	Chowdhuri, B.	Saxena, Y.C.
1977	Chowdhuri, B.	Saxena, Y.C.
1983	Chaudhuri, B.	Ganguly, A.K.
1985	Ganguly, A.K.	Chaudhuri, B. and Baliga, B.B.
1987	Ganguly, A.K.	Chaudhuri, B. and Baliga, B.B.
1987	Ganguly, A.K.	Chaudhuri, B.; Mitra, B.; Sen, S.; Baliga, B.B.
1988	Bhattacharyya, D.P.	Pal, P. and Chowdhuri, B.
1989	Bhattacharyya, D. P.	Pal, Pratibha; Basu, Basudhara; Rakshit, Ruma; Mukherjee, S. C.; Ganguly, A. K.; Chowdhuri, Biva; Biswas, S.; Durgaprasad, N.
1990	Ganguly, A.K.	Chaudhuri, B.; Bhattacharyya, D.P.; Pal, P.; Basu, B.; Rakshit, R.; Mukherjee, S. C.

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, $PBC = (4/14) \times 100 = 28.57$.

Publication Density (PD)

PD is the ratio of the total number of papers published to the total number of channels. Here, $PD = 28/14 = 2$.

Bradford's Law

As per the number of channels divided into three zones in Table 7, the ratio = 2: 3: 9. So, according to the Bradford's Law, $2: 2 \times 2.25: 2 \times 2.25 \times 2.25$ or $2: 4.5: 10.13$. Total = 16.63. Percentage error = $[(16.63 - 14)/ 14] \times 100 = [0.19] \times 100 = 19\%$, which is not negligible as the values to Bradford's Law is far difference. Therefore, the data set does not satisfy Bradford's law.

Citations

Table 8 and Figure 2 the distribution of citations received by papers. The highest number of papers i.e. 11 fall within the 1-5 citation range. This is followed by 10 papers that have not received

any citations. Additionally, 3 papers received between 16-20 citations, while 2 papers fall in the 11-15 citation range. Only 1 paper has been cited 6-10 times. Notably, one paper stands out with the highest citation count, falling within the 21-25 citation range.

It is important to note that Bibha's publications are not systematically organized and are not indexed in major Abstracting and Indexing databases such as Google Scholar or ResearchGate. As a result, her work remains relatively inaccessible to contemporary readers and researchers.

Keyword Tomography

Table 9 presents the frequency of keywords appearing in the titles of Bibha's research papers. The keyword "Extensive Air Showers (EAS)" appears most frequently, with 7 occurrences, followed by "Photographic Plate" (5 times) and "Cosmic Ray" (4 times). Additionally, a group of eight keywords appears twice each, while 27 distinct keywords occur only once across her publications. Notably, the top three keywords highlight the core areas of her research and reflect the scientific contributions for which she is most recognized.

Table 6: List of Publication Channels.

Sl. No.	Publication Channels (founded in)	Types	TP	%-age	YFP	YLP	IF	Country	h- index
1	Nature (f.1869)	JA	5	17.87	1940	1948	50.500	UK	1442
2	Proceedings of the Indian Academy of Sciences, Section A (f. 1930)	JA	4	14.29	1952	1973	0.200	India	46
3	Indian Journal of Physics (f. 1926)	JA	3	10.71	1944	1990	1.947	India	38
4	Nuovo Cimento (f.1855)	JA	3	10.71	1956	1988	5.900	Italy	41
5	Transactions of the Bose Research Institute f. 1938)	JA	3	10.71	1939	1944	NA	India	NA
6	Pramana: J. Phys. (f. 1973)	JA	2	7.15	1975	1977	2.669	India	58
7	Fizika: a journal of experimental and theoretical physics (f. 1955 in English)	JA	1	3.57	1989	1989	1.100	Russia	NA
8	International Journal of Radiation Applications and Instrumentation. Part D. Nuclear Tracks and Radiation Measurements (f. 1986)	JA	1	3.57	1987	1987	1.513	UK	41
9	Phys.Rev. (f.1893)	JA	1	3.57	1944	1944	8.100	USA	700
10	Proc.Roy.Soc.Lond. (f. 1831)	JA	1	3.57	1950	1950	2.900	UK	144
11	Science and Culture (f. 1935)	JA	1	3.57	1985	1985	2.500	India	49
12	In Cosmic Radiation: Volume I of the Colston Papers (pp. 101-110). Butterworth's Scientific Publications.	BC	1	3.57	1949	1949	NA	UK	NA
13	In H.S. Virk (Ed.), Proceedings of the 3rd National Conference on Solid State Nuclear Track Detectors (p. 45). Guru Nanak Dev University.	CP	1	3.57	1983	1983	NA	India	NA
14	University of Manchester (f.1824), Manchester (OCLC 643572452)	Thesis	1	3.57	1949	1949	NA	UK	NA
Total			28	100					

Table 7: Bradford's distributions.

Zones	No. of Articles	No. Journals	Bradford Multiplier
I	9	2	
II	9	3	1.5 (= 3/2)
III	10	9	3.0 (= 9/3)
Total	28	14	
	Average Multiplier		2.25

Table 8: Frequency distribution of citations.

Class (Citations)	Frequency (Papers)	%-age
0	10	35.71
1-5	11	39.29
6-10	1	3.57
11-15	2	7.14
16-20	3	10.72
21-25	1	3.57
Total	28	100

Table 9: List of keywords with frequencies.

Sl. No.	Keywords	Frequency
1	Extensive Air Showers (EAS)	7
2	Photographic plate	5
3	Cosmic rays	4
4	CR-39	2
5	Heavy ionization particles	2
6	Ionizing particles	2
7	Mass of the mesotron.	2
8	Multiple penetrating particles	2
9	Narrow separation	2
10	Photographic method	2
11	Penetrating particles	2
12	$^{12}\text{C}(^4\text{He}, \text{HI})$ reaction	1
13	1.88A GeV.	1
14	33.8 MeV.	1
15	$^{56}\text{Fe}+^{27}\text{Al}$ collisions	1
16	Air showers	1
17	Chamonix.	1
18	Charge phenomena	1
19	Cosmic ray showers.	1
20	Cosmic-Ray meson spectra	1
21	Extensive penetrating showers.	1
22	Heavy ions	1
23	High energy muons	1
24	Large underground showers	1
25	Mass determination	1
26	Meson mass.	1
27	Mesotron showers	1
28	Multiplate cloud chamber	1
29	Multiple ionization track spectra	1
30	Multiple muons	1
31	Nuclear disintegration	1
32	Penetrating events	1
33	Photographic emulsion:	1

Sl. No.	Keywords	Frequency
34	Protons	1
35	Rock and lead	1
36	S-events	1
37	Very high-energy neutrons.	1
38	α -particles	1

CONCLUSION

Bibha Chowdhuri was a brilliant physicist, a pioneering woman in science, and a key contributor to early cosmic ray and particle physics research. Her story underscores how gender and geopolitical inequalities can shape the history of science, often sidelining deserving contributors. While her name may not be etched in the annals of Nobel Prizes or science textbooks, her work continues to ripple through the foundations of particle physics in India and beyond. As more light is shed on her life and legacy, Bibha Chowdhuri is gradually being restored to her rightful place in the history of science. Her story, as highlighted in the biography and through the star naming, has served as an inspiration for young girls and women interested in science, particularly physics.

ACKNOWLEDGEMENT

This work is dedicated to our respected teacher, the late Professor (Dr) B. K. Sen, an eminent bibliometrician and information scientist whose enduring inspiration taught us to honour others through the scientometric lens. His guidance continues to shape our academic journey and our efforts to recognize the contributions of pioneers in science.

ABBREVIATIONS

TP: Total Publications/Papers; **CP:** Cumulative Papers; **AA:** Author's Biological Age; **PPA:** Paper Productive Age; **SAP:** Single-Authored Paper; **MAP:** Multi-Authored Paper; **DC:** Degree of Collaboration; **CoA:** Co-authors; **YFP:** Year of First Publication; **YLP:** Year of Last Publication; **IF:** Impact Factor; **JA:** Journal Articles; **BC:** Book Chapters; **CP:** Conference Papers; **FPA:** Fifty Percentile Age; **PPA:** Paper Productive Age.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

SUMMARY

This paper presents a bibliometric narrative of Dr. Bibha Chowdhuri's significant contributions to cosmic ray research and her lasting scientific legacy, symbolized by the naming of a yellow-white star, 'Bibha', in her honor. Despite working in an era marked by gender and geopolitical inequalities, her research paralleled that of Nobel laureates such as P.M.S. Blackett and

Cecil Powell. While her work went largely uncredited during her lifetime, Powell notably cited the foundational efforts of Bibha Chowdhuri and her collaborator D.M. Bose. The study reconstructs her scholarly contributions-spanning 1939 to 1990-through alternative sources such as her incomplete CV, citations in other researchers' works, and various digital archives, due to the limited availability of her papers in mainstream academic databases. Employing standard bibliometric methods, the paper compiles a scientometric profile encompassing 28 research publications, of which 8 are solo-authored and 20 collaboratives, yielding a Degree of Collaboration of 0.71. Her peak productivity occurred in 1944, and impressively, 64% of her work was produced after the age of 50. Collaborators such as D.M. Bose and A.K. Ganguly played a significant role in her research journey. Most of her work appeared in reputable journals, including four papers published in *Nature*, which has a current h-index of 1442. A keyword analysis highlights the central themes of her research in Cosmology and Astroparticle Physics. Dr. Chowdhuri's posthumous recognition-28 years after her passing-affirms her place in scientific history. As an Indian physicist, she stands out as a beacon of perseverance and intellectual brilliance, continuing to inspire generations of women in science worldwide.

REFERENCES

- Behera, M., and Meher, D. (2024). Scientometric Portrait of Dr Raghuram Rajan: An Economist and 23rd RBI Governor. *Journal of Data Science, Informetrics, and Citation Studies*, 3(2), pp. 206-15.
- Bhattacharya, A. (2018, November 25). The woman who could have won a Nobel. <https://www.telegraphindia.com/science-tech/the-woman-who-could-have-won-a-nobel/cid/1676488>. The Times of India Online.
- Bhowal, U. (2022, March 8). An exclusive excerpt from 'The Gutsy Girls of Science' by Ilina Singh: On Women's Day, a look at two of India's most eminent female scientists. The Times of India Online. <https://www.telegraphindia.com/my-kolkata/lifestyle/>
- Dutta, B. (2019). Bibliometric Portrait of B K Sen: A Librarian, Information Scientist and scientometrician. *Malaysian Journal of Library and Information Science*, 24(1), pp. 1-21.
- Gupta, S. K. (2021). The legacy of Dr. Bibha Chowdhuri and Astroparticle Physics in India. *Physics News*, 51(1-2).
- Huded, S., Vanjari, R., Alam, A., and S., T. (2023). Professor Madhav Gadgil: A Bibliometric Portrait. *Journal of Data Science, Informetrics, and Citation Studies*, 2(3), 243-54., 2(3), pp. 243-254.
- Hussain, A., and Shakoar, N. (2022). Contributions to the Field of Library and Information Sciences in Pakistan: A Bio Bibliometric Study of Dr. Saeed Ullah Jan. *Library Philosophy and Practice (ejournal)*, 7510.
- Kautilya. (2018, Dec 5). Bibha Chowdhuri - Celebrating a Forgotten Life in Physics. https://dharmakshethra.com/bibha-chowdhuri-celebrating-a-forgotten-life-in-physics/?utm_source=chatgpt.com. Heritage: Indian Legends.
- Kavi, P., and Singh, D. (2024). Scientometric Portrait of Roddam Narasimha, an Indian Aerospace Scientist. *Kelpro Bulletin*, 28(2), 37-55.
- Koley, S. (2023, July-December). Biobibliometric portrait of Dr. Dilip Mhalanabis, pioneer of oral rehydration solution (ORS), the life-saving solution. *International Journal of Library and Information Science*, 15(2), pp. 14-31. doi:10.5897/IJLIS2023.1077
- Koley, S. (2024). Medicimetric Portrait of Dr. Subhas Mukherjee, Late recognized Pioneer of Historic Creation of India's First and World's Second IVF Baby. *Journa of Data Science, Informetrics and Citation Studies*, 3(1), pp. 42-57. <https://www.jcitati.on.org>.
- Koley, S. (2025). A Bio-Bibliometric Analysis of Dr. Suprabhat Mukherjee, a Pioneer of Innovative Approach for Colon Cancer Treatment Using Fluids of Custard Apple (*Annona reticulata*) Seeds. Research and Review: *Journal of Statistics*, 14(1), 49-62.
- Koley, S., and Sen, B. (2016). Bibliometric Portrait of V L Kalyane, a Steller Biobibliometrician. *Annals of Library and Information Studies*, 63, 161-175.
- Koley, S., and Sen, B. K. (2017, December). Biobibliometric portrait of the astronomer Jan Hendrik Oort. *Annals of Library and Information Studies*, 64, pp. 217-228.
- Manjunath, M., and Ramesha. (2015). Bio-bibliometric profile of Sir. C.V. Raman as seen through Google Scholar. *International Journal of Library and Information Studies*, 5, 41.
- Mondal, D., Raychoudhury, N., and Sarkhel, J. (2018). Scientific contribution of Professor Mahalanobis: a bio-bibliometric study. *Current Science*, 115 (8), pp. 1470-1476.
- Mondal, N. K. (2023, October). Bibha Chowdhuri and Her Remarkable Scientific Endeavours. *Resonance*, 28(10), pp. 1459-1504.
- Mukherjee, B. (2013). A Scientometric Profile of Prof. Laljit Singh as seen through Web of Science and Scopus. *Annals of Library and Information Studies*, 60(3), 195-203.
- Roy, S. C., and Sigh, R. (2018, May-June). Bibha Chowdhuri: An Unknown Indian Woman Scientist. *Science and Culture*, 84(5-6), pp. 159-164.
- Roy, S. C., and Singh, R. (2021). Bibha Chowdhuri - The First Woman Scientist at the TIFR. *Physics News*, 51(1-2), pp. 4-11.
- San Diego2. (n.d.). Bibha Chowdhuri: A Woman of Firsts with No Recognition. <https://sd2.org/bibha-chowdhuri-a-woman-of-firsts-with-no-recognition/>.
- Sangam, S., and Savanur, K. (2010). Eugene Garfield: A scientometric portrait. *Collnet Journal of Scientometrics and Information Management*, 41(4), pp. 41-51.
- Saxena, Y. C. (2021). Dr. Bibha Chowdhuri at PRL: Work and Reminiscences. *Physics News*, 51(1-2).
- Shivaraja. (2023). Bio-Bibliometric Analysis of Research Output of Prof. K.R.Venugopal. *Library and Philosophy and Practice (e-journal)*, 7976.
- Teli, S., and Maity, A. (2021, June). A Bio-Bibliometric Portait of Stephen William Hawking. *IASLIC Bulletin*, 66(2), pp. 122-128.
- Varaprasad, S. J., Sahoo, S., and S., M. (2010). Research Contributions of J. S. Yadav to Chemical Sciences: A Scirntometric Study. *Malaysian Journal of Library and Information Science*, 15(2), 41-55.
- Wikipedia. (2025, May 26). Bibha Chowdhuri. https://en.wikipedia.org/wiki/Bibha_Chowdhuri.
- Yasmin, M. (2019). Scientometric Portrait of Prof. Kasi Pitchumani: An Organic Chemistry Catalyst. *Library and Philosophy and Practice (e-journal)*, 2377.

Cite this article: Koley S, Goswami S. From Earth to the Stars: A Bio-Bibliographic Tribute to the Inspiring Legacy of Bibha Chowdhuri. *Info Res Com*. 2025;2(2):182-92.