

Bio-bibliometric profile of Sir. C.V. Raman as seen through Google Scholar**Manjunath M**

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Abstract

Bio-bibliometrics is a term that was first coined by Sen and Gan to mean the quantitative and analytical method for discovering and establishing functional relationships between bio-data and biblio-data elements. Kademani and Kalyane were the first to use the phrase "Scientometric portrait" to carry out bio-bibliometric studies on scientists including Nobel laureates. Bibliometric techniques are being used for a variety of purposes like determination of various scientific indicators, evaluation of scientific output. The term 'Bio-bibliometrics' is being used for method of retrieving and visualizing biological information that uses co-occurrence of gene naming terms in Medical Sciences to generate semantic links between genes. Bio-bibliometric is a study in which we statistically analyze publications of an individual, a department, or a subject of any field. It is a quantitative and analytical method in which we try to establish a functional relation between bio-data of an individual and his biblio-data. It is a technique used for the documenting works of eminent scientists and researchers. In this study an attempt has been made to analyze the communication and collaboration pattern of Sir. C.V. Raman as reflected through Google Scholar.

Keywords: Bio-bibliometric, C.V. Raman, Channels of communication, Google Scholar

1. Introduction

Google Scholar is a freely accessible web search engine that indexes the full text or metadata of scholarly literature across an array of publishing formats and disciplines (wiki 2015). Google Scholar index includes most peer-reviewed online journals, scholarly books and other non-peer reviewed journals. Google Scholar allows users to search for digital or physical copies of articles, whether online or in libraries. Through its "cited by" feature, Google Scholar provides access to abstracts of articles that have cited the article being viewed. This feature provides the citation indexing previously only found in Scopus and Web of Knowledge. GS has emerged as an alternative to the well known citation databases, the Web of Science and Scopus. The freely availability of the GS and its extensive coverage is being looked at by researchers for evaluative studies despite its many limitations (Patra 2014). Based on GS, this study tried to trace the citation and authorship patterns of the papers published by Sir. C. V. Raman. An attempt has been made in this study to analyze and interpret the data collected from research publications of Sir. C. V. Raman as reflected from Google Scholar. The analysis includes year wise distribution of publications; authorship pattern, collaboration for publication; and journal preferences for the publication. Google

Scholars' automatic processing sometimes creates illogical results; to overcome this, a Google Citation Scholar profile has been created for Sir. C. V. Raman and added all his publications to the same.

Based on the GS profile, an attempt was made to analyze the amount of literature that has been contributed by Sir. C. V. Raman. There are 480 articles indexed in Google Scholar. Year wise distribution of publications is shown in Table – 1.

2 . Objectives of the Study

- To know the authorship pattern, collaborative research pattern of Sir. C.V. Raman
- To identify the Core Channels of Communication and distribution of publications
- To compare the research output, in terms of the number of citation received, and how far his top cited works have importance in present study

3. Brief profile of Sir. C.V. Raman

Chandrasekhara Venkata Raman (C. V. Raman) was born at Trichinopoly in Southern India on November 7th, 1888. His father was a lecturer in mathematics and physics so that from the first he was immersed in an academic atmosphere. He entered Presidency College, Madras, in 1902, and in 1904 passed his B.A. examination, winning the first place and the gold medal in physics; in 1907 he gained his M.A. degree, obtaining the highest distinctions. His earliest researches in optics and acoustics - the two fields of investigation to which he has dedicated his entire career - were carried out while he was a student.

Since at that time a scientific career did not appear to present the best possibilities, Raman joined the Indian Finance Department in 1907; though the duties of his office took most of his time, Raman found opportunities for carrying on experimental research in the laboratory of the Indian Association for the Cultivation of Science at Calcutta (of which he became Honorary Secretary in 1919). In 1917 he was offered the newly endowed Palit Chair of Physics at Calcutta University, and decided to accept it. After 15 years at Calcutta he became Professor at the Indian Institute of Science at Bangalore (1933-1948), and since 1948 he was Director of the Raman Institute of Research at Bangalore, established and endowed by him. He also founded the *Indian Journal of Physics* in 1926, of which he is the Editor. Raman sponsored the establishment of the Indian Academy of Sciences and has served as President since its inception. He also initiated the *Proceedings* of that academy, in which much of his work has been published, and is President of the Current Science Association, Bangalore, which publishes *Current Science (India)*.

Some of Raman's early memoirs appeared as Bulletins of the *Indian Association for the Cultivation of Science* (Bull. 6 and 11, dealing with the "Maintenance of Vibrations"; Bull. 15, 1918, dealing with the theory of the musical instruments of the violin family). He contributed an article on the theory of musical instruments to the 8th Volume of the *Handbuch der Physik*, 1928. In 1922 he published his work on the "Molecular Diffraction of Light", the first of a series of investigations with his collaborators which ultimately led to his discovery, on the 28th of February, 1928, of the radiation effect which bears his name ("A new radiation", *Indian J. Phys.*, 2 (1928) 387), and which gained him the 1930 Nobel Prize in Physics.

Other investigations carried out by Raman were: his experimental and theoretical studies on the diffraction of light by acoustic waves of ultrasonic and hypersonic frequencies (published 1934-1942), and those on the effects produced by X-rays on infrared vibrations in crystals exposed to ordinary light. In 1948 Raman, through studying the spectroscopic behaviour of

crystals, approached in a new manner fundamental problems of crystal dynamics. His laboratory has been dealing with the structure and properties of diamond, the structure and optical behaviour of numerous iridescent substances (labradorite, pearly felspar, agate, opal, and pearls). Among his other interests have been the optics of colloids, electrical and magnetic anisotropy, and the physiology of human vision. Raman has been honored with a large number of honorary doctorates and memberships of scientific societies. (Kademani 1994, Venkataraman 1988, Ramaseshan 1988) Sir Chandrasekhara Venkata Raman died on November 21, 1970.

4. Results and Discussion

An attempt was made to analyze the amount of literature that has been contributed by Sir. C.V. Raman. Figure – 1 depicts the year-wise distribution of articles. There are 480 articles indexed in Google Scholar. As shown in figure – 1, in 65 years of publication Sir. C.V. Raman had published on an average of 7-8 articles per year, while no publication have been noted in the year 1933. Highest numbers of articles have been appeared in the year 1962 (34, 7.08%) followed by 1965 (22, 4.58%) and 1963 (21, 4.37%).

Year	No. of Publications	Cumulative Frequency	%	Year	No. of Publications	Cumulative Frequency	%
1906	1	1	0.21	1939	5	212	1.05
1907	2	3	0.42	1940	9	221	1.89
1908	1	4	0.21	1941	8	229	1.68
1909	6	10	1.26	1942	10	239	2.10
1910	2	12	0.42	1943	5	244	1.05
1911	4	16	0.84	1944	6	250	1.26
1912	4	20	0.84	1945	3	253	0.63
1913	2	22	0.42	1946	3	256	0.63
1914	3	25	0.63	1947	8	264	1.68
1915	3	28	0.63	1948	3	267	0.63
1916	3	31	0.63	1949	3	270	0.63
1917	4	35	0.84	1950	9	279	1.89
1918	7	42	1.47	1951	5	284	1.05
1919	10	52	2.10	1952	4	288	0.84
1920	8	60	1.68	1953	7	295	1.47
1921	18	78	3.78	1954	13	308	2.73
1922	18	96	3.78	1955	11	319	2.31
1923	14	110	2.94	1956	8	327	1.68
1924	3	113	0.63	1957	10	337	2.10
1925	10	123	2.10	1958	6	343	1.26
1926	8	131	1.68	1959	6	349	1.26
1927	19	150	4.00	1960	8	357	1.68
1928	14	164	2.94	1961	8	365	1.68
1929	11	175	2.31	1962	34	399	7.15
1930	1	176	0.21	1963	21	420	4.42

1931	7	183	1.47	1964	11	431	2.31
1932	1	184	0.21	1965	22	453	4.63
1933	0	184	0.00	1966	14	467	2.94
1934	4	188	0.84	1967	1	468	0.21
1935	3	191	0.63	1968	3	471	0.63
1936	12	203	2.52	1969	6	477	1.26
1937	1	204	0.21	1970	3	480	0.63
1938	3	207	0.63				

Table 1: Year-wise contribution of articles

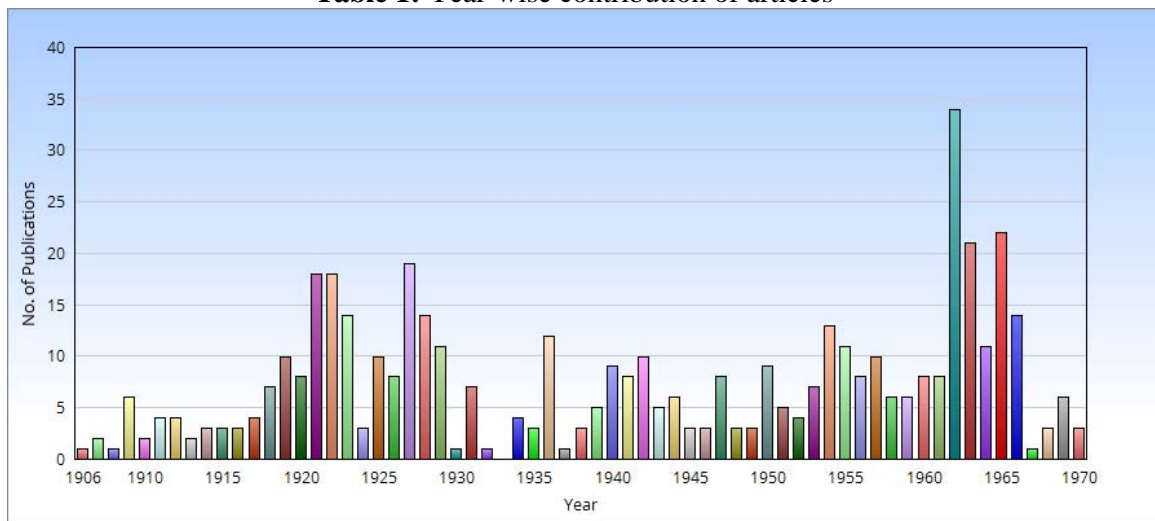


Figure 1: Year-wise contribution of articles

Authorship pattern

Table 2 depicts the authorship pattern, during 1906-70, Sir. C.V. Raman has published 480 papers of which single authorship papers were 339(70.62%), two authorship papers were 138(28.75%) and three authorship papers were only 3(0.62%).

Table 2: Authorship Pattern

Year	Single and Multi authored Papers			Total
	Single	Two	Three	
1906	1	-	-	1
1907	2	-	-	2
1908	1	-	-	1
1909	6	-	-	6
1910	2	-	-	2
1911	4	-	-	4
1912	4	-	-	4
1913	2	-	-	2
1914	3	-	-	3
1915	3	-	-	3
1916	2	1	-	3
1917	1	3	-	4
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1939	-	5	-	5
1940	-	9	-	9
1941	4	2	2	8
1942	10	-	-	10
1943	5	-	-	5
1944	5	1	-	6
1945	3	-	-	3
1946	2	1	-	3
1947	8	-	-	8
1948	3	-	-	3
1949	1	2	-	3
1950	6	2	1	9

1918	6	1	-	7	1951	5	-	-	5
1919	8	2	-	10	1952	-	4	-	4
1920	5	3	-	8	1953	1	6	-	7
1921	10	8	-	18	1954	1	12	-	13
1922	16	2	-	18	1955	4	7	-	11
1923	7	7	-	14	1956	8	-	-	8
1924	2	1	-	3	1957	10	-	-	10
1925	3	7	-	10	1958	6	-	-	6
1926	6	2	-	8	1959	5	1	-	6
1927	7	12	-	19	1960	8	-	-	8
1928	3	11	-	14	1961	8	-	-	8
1929	7	4	-	11	1962	34	-	-	34
1930	1	-	-	1	1963	21	-	-	21
1931	4	3	-	7	1964	11	-	-	11
1933	0	0	0	0	1965	22	-	-	22
1932	-	1	-	1	1966	14	-	-	14
1934	4	-	-	4	1967	1	-	-	1
1935	1	2	-	3	1968	3	-	-	3
1936	-	12	-	12	1969	6	-	-	6
1937	-	1	-	1	1970	3	-	-	3
1938	-	3	-	3	-	-	-	-	-

Table – 3 lists the 39 different authors who have contributed with Sir.Sir. C.V. Raman in various disciplines. Among them Krishnan K.S.(21), Nagendra Nath N.S. (14), and Jayaraman A (13) are top three collaborators with whom he has published 48 papers.

Table 3: Authorship credits of researchers collaborating with Sir. C.V. Raman

Co-author Name	Total Co-authored articles (%)	Period of Association		
		From	To	Total Years
Appaswamaiyer, S.	01	1916	-	01
Banerji, Bhabonath	04	1920	1921	02
Banerji, K.	01	1925	-	01
Bhagavantam, S.	04	1929	1932	04
Bhat, M.R.	03	1953	1955	03
Chinchalkar, S.W.	01	1931	-	01
Datta, GoverdhanLal	01	1921	-	01
Datta, S.K.	02	1925	-	01
Dey, Ashutosh	06	1917	1920	04
Ganesan, A.S.	02	1923	1924	02
Ghosh, P.N.	01	1918	-	01
Jayaraman, A.	13	1950	1955	06
Krishnamurti, D.	10	1952	1955	04
Krishnamurti, P	01	1929	-	01
Krishnan, K.S.	21	1925	1929	05

Kumar, Sivakali	01	1920	-	01
NagendraNath, N.S.	14	1936	1940	05
Nedungadi, T.M.K.	04	1939	1941	03
Nilakantan, P.	07	1940	1941	02
Pancharatnam, S.	01	1959	-	01
Raghavendra Rao, B.V.	04	1935	1938	04
Rajagopalan, V.S.	06	1939	1941	03
Ramakrishna Rao, J.	02	1926	1927	02
Ramanathan, K.R.	04	1923	-	01
Ramaseshan, S.	03	1946	1949	04
Ramdas, A.K.	02	1954	-	02
Ramdas, L.A.	04	1925	1927	03
Ray, Bidhubhusan	01	1921	-	01
Rendall, G.R.	01	1944	-	01
Sethi, Nihal Karan	01	1922	-	01
Sheshagiri Rao, K.	03	1921	1923	03
Sirkar, S.C.	01	1928	1928	01
Sogani, C.M.	03	1927	1928	02
Srinivasan, T.K	01	1950	1950	01
Subbaramaiah, K.	02	1938	1939	02
Sutherland, G.A.	03	1921	1921	01
Tamma, V.S.	01	1922	1922	01
Venkateswaran, C.S.	01	1938	1938	01
Viswanathan, K.S.	04	1955	1955	01

Channels of Communication

On the basis of analysis it is found that there are 21 journals in which Sir.C.V. Raman has published 480 papers of which top three are *Proceedings of the Indian Academy of Sciences - A* (205, 42.70%), *Nature* (91, 18.95%) and *Current Science* (68, 14.16%).

Table 4: Dissemination of the channels of communication

Channel of Communication	No. of Papers	Cumulative
Applied Optics	01	01
Astrophysical Journal	04	05
Bulletin of the Calcutta Mathematical Society	02	07
Bulletin of the Indian Association for the Cultivation of Science	07	14
C. R. Academy of Sciences, Paris	01	15
Current Science	68	83
Handbuch Der Physik, Chapter 8		
Indian Journal of Physics	06	89
Journal of Dept. of Science, Universtiy of Calcutta	01	90
Journal of Indian Mathematical Club	02	92
Journal of Madras University	01	93
Journal of the Optical Society of America	04	97

Nature	91	188
Philosophical Magazine	39	227
Physical Review	11	238
Proceedings of Indian Academy of Sciences – A	205	443
Proceedings of the Indian Association for the Cultivation of Science	04	447
Proceedings of the Royal Society of London – A	25	472
The Annals of the American Academy of political and Social Science	01	473
Transactions of the Faraday Society	04	477
ZeitschriftfürPhysik	01	478

Performance of Research by Citations received

Table 5: Highly cited articles

SL. No.	Title	Citations	Year
1	A new type of secondary radiation CV Raman, KS Krishnan Nature 121 (3048), 501-502	1327	1928
2	The diffraction of light by high frequency sound waves. Part I CV Raman, NS Nagendra Nath Proceedings of the Indian Academy of Sciences, Section A 2 (4), 406-412	594*	1935
3	A new radiation CV Raman Indian Journal of physics 2, 387-398	495	1928
4	A change of wave-length in light scattering CV Raman Nature 121 (3051), 619-619	160	1928
5	The diffraction of light by high frequency sound waves: Part III CV Raman, NSN Nath Proceedings of the Indian Academy of Sciences-Section A 3 (1), 75-84	109	1936
6	The diffraction of light by high frequency sound waves- Part II CV Raman, NS Nagendra Nath Proceedings of the Indian Academy of Sciences 2, 413- 420	103	1936
7	On the mechanical theory of the vibrations of bowed strings and of musical instruments of the violin family, with experimental verification of the results, Part I CV Raman Bulletin of the Indian Association for the Cultivation of Science 15, 1-158	101	1918

8	The α - β transformation of quartz CV Raman, TMK Nedungadi Nature 145 (3665), 147-147	88	1940
9	The photographic study of impact at minimal velocities CV Raman Physical Review 12 (6), 442-447	81	1918
10	The optical analogue of the Compton effect CV Raman, KS Krishnan Nature 121 (3053), 711-711	77	1928

Table 5 shows top 20 highly cited publications of Sir. C.V. Raman.

Conclusion:

Publication productivity analysis of the successful scientist like Sir. C.V. Raman, will throw light on his pivotal contribution to science and technology. He can be considered as a role model for younger researchers to follow. Narrating success stories always has an encouraging effect. It is also important to recognize that excellence in science is not just a matter of a few individual successes, what is required is a wide base of high quality, which would enable peaks to come up more frequently and on a more definite basis. New ways to motivate scientists seem as important to contest outcome as new sources of funds. Science policy makers interested to know about functioning of active research teams as centers of excellence and factors responsible for optimizing, maximizing and enhancing outputs may find further interest in Bio-bibliometrics.

References:

1. Swapan Kumar, Patra. "Google Scholar based citation analysis of Indian Library and Information Science Journals." *Annals of Library and Information Studies*. 61 (2014):227-234
2. Kademani B.S. et al. "Scientometric portrait of Nobel Laureate Dr. C.V. Raman." *Indian Journal of Information, Library and Society*. 7(1994):215-249.
3. Venkataraman, G. *Journey into Light: Life and Science of C.V. Raman*. Bangalore: Indian Academy of Sciences, 1988.
4. Ramaseshan S. Ed. *Scientific papers of C V Raman Vols.1 – 6*. Bangalore: Indian Academy of Sciences, 1988.
5. Wikipedia: Google Scholar. Web March 5, 2015
http://en.wikipedia.org/wiki/Google_Scholar

