

RESEARCH PRODUCTIVITY OF AUTHORS IN NUCLEAR PHYSICS: A SCIENTOMETRIC PROFILE

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ABSTRACT

This study employs Scientometric analysis to examine 5,292 bibliometric publications retrieved from the Web of Science database spanning the period of 1989 to 2020. The analysis was conducted using HistCite software and focused on several quantitative research aspects, including the growth of papers on a year-by-year basis, Collaborative Index (CI), Co-authorship Index (CAI), and Degree of Collaboration. By investigating these metrics, this study seeks to shed light on the productivity and collaborative patterns of authors in the field of Nuclear Physics.

Keywords: *Scientometrics, Author Productivity, Nuclear Physics, Co-Authorship Index, Degree of Collaboration.*

Introduction

Nuclear physics plays a crucial role in various fields that impact our daily lives. While nuclear power generation is a well-known application of nuclear physics, the field also encompasses particle physics, which is taught in conjunction with nuclear physics. From medicine to materials science, energy production to security, and climatology to numerous other sciences, many of the advancements that have transformed these fields stem from basic research and development in nuclear physics.

This study focuses on applying Scientometric analysis to evaluate the productivity and impact of authors in the field of Nuclear Physics. Specifically, the study will examine the author's productivity, collaborative patterns, degree of collaboration, and co-authorship index.

Review of Literature

Ranganathan and Sumathi (2021) conducted a study on the publication of Geochemistry, using data from the Web of Science database for the period 1989-2020. Jahina, Batcha, and Ahmad (2020) explored scientometric aspects of Brain Concussion Research, analyzing various quantitative aspects such as the growth of papers, collaborative indices, co-authorship indices, and Lotka's exponent value, among others, using Bibexcel software. Similarly, Satish Kumar and Senthilkumar (2019) studied the scientific productivity pattern of authors in the field of Astronomy & Astrophysics research in India, examining the applicability of Lotka's law in the literature using data

from the WoS database. In another study, Pillai Sudhier (2013) analyzed authorship distribution in physics literature and verified the validity of Lotka's law of scientific publication productivity using a compilation of journal articles cited in doctoral theses from the University of Kerala, Thiruvananthapuram, South India.

Objective of the Study

1. To identify the growth of publications on Nuclear Physics over time.
2. To assess the productivity of authors in the field of Nuclear Physics.
3. To measure the degree of collaboration among authors in the field of Nuclear Physics.
4. To analyze the collaborative patterns of authors in the field of Nuclear Physics.
5. To determine the co-authorship index and networks among authors in the field of Nuclear Physics.

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Methodology

This study collected data from the Web of Science Core Collection using “Nuclear Physics” as the search string for a period of 32 years from 1989 to 2020. The data was analyzed using HistCite software and further analyzed in MS Excel for tabulation and visualization purposes. The study aimed to gain insights into the productivity and collaboration patterns of authors in Nuclear Physics and provide a comprehensive understanding of the current state and trends in research in the field.

Data Analysis and Interperitation

Growth of Publications

Table-1 shows that a total of 5292 publications were published during the period 1989-2020. The highest publication was 323 published in 2020 with 1232 Global Citation Scores followed by 275 papers in 2016 with 5290 Global Citation Scores and 259 papers in 2015 with 3743 Global Citation Scores. The lowest publication was 27 published in 1989 with 714 Global Citation Scores. All these 5292 publications have 137762 cited references. It shows that there is a healthy trend in citing a reference found among the global Scientists of “Nuclear Physics”.



Table1: Year-wise distribution of Publications and Citation Score

S. No	Publication	Publication	%	Cum. Publication	Cum.%	TLCS	TGCS
	Year						
1	1989	27	0.5	27	0.51	77	714
2	1990	37	0.7	64	1.21	41	365
3	1991	91	1.7	155	2.93	88	3072
4	1992	97	1.8	252	4.76	85	2431
5	1993	109	2.1	361	6.82	50	2342
6	1994	92	1.7	453	8.56	40	1682
7	1995	99	1.9	552	10.43	105	1969
8	1996	109	2.1	661	12.49	127	5843
9	1997	108	2	769	14.53	119	2474
10	1998	111	2.1	880	16.63	92	2803
11	1999	145	2.7	1025	19.37	182	4159
12	2000	125	2.4	1150	21.73	48	2399
13	2001	140	2.6	1290	24.38	83	2701
14	2002	135	2.6	1425	26.93	118	3863
15	2003	166	3.1	1591	30.06	376	18831
16	2004	165	3.1	1756	33.18	183	5198
17	2005	175	3.3	1931	36.49	122	5134
18	2006	165	3.1	2096	39.61	192	6601
19	2007	152	2.9	2248	42.48	212	4031
20	2008	205	3.9	2453	46.35	154	4015
21	2009	185	3.5	2638	49.85	171	3254
22	2010	183	3.5	2821	53.31	248	5178
23	2011	202	3.8	3023	57.12	217	4683
24	2012	226	4.3	3249	61.39	118	7475
25	2013	244	4.6	3493	66.01	167	6034
26	2014	220	4.2	3713	70.16	84	3197
27	2015	259	4.9	3972	75.06	119	3743
28	2016	275	5.2	4247	80.25	139	5290
29	2017	235	4.4	4482	84.69	49	2940
30	2018	239	4.5	4721	89.21	71	3379
31	2019	248	4.7	4969	93.9	24	1763
32	2020	323	6	5292	100	7	1232
Total		5292	100			3908	128795

2 Ranking of Authors' Productivity Based on Publications



Table-2 indicates the ranking of authors in terms of the number of publications. “Hatanaka K” published the highest number of articles in the study period with 52 publications, and also had the highest citation score of 1023. The following authors “Tamii A” published the next highest citation number of articles for the study period with 51 records and also had the next highest citation score of 1002. Thus, the most-cited authors are distinguished from the most-published ones.

Table -2
Ranking of Prolific Authors based on Publications

S. No	Author	Articles	%	TLCS	TGCS	TLCR
1	Hatanaka K	52	1	65	1023	72
2	Tamii A	51	1	71	1002	92
3	Olko P	33	0.6	42	451	31
4	Blaum K	30	0.6	98	1655	115
5	Fujita Y	30	0.6	88	1801	64
6	Wiescher M	30	0.6	125	1395	104
7	Rauscher T	29	0.5	94	1545	99
8	Dubovichenko SB	28	0.5	76	132	59
9	Schatz H	28	0.5	132	1440	75
10	Zilges A	26	0.5	30	406	108
Total			6.4	821	10850	819

3. Single vs Multiple Authored, Co-Authorship Index Research Output and Degree of Collaboration

Table-3 shows that the single-author contributed papers constitute 31.97% of the publications whereas the majority (68.03%) of the papers are contributed by multi-authors.

The degree of collaboration is 0.68 during the study period i.e., out of a total of 5292 literature published, 68% of them were published under the joint authorship pattern

in Nuclear Physics research output. The period-wise analysis indicates that its level is somewhat less in the first period (1989-2004: 0.61). An increasing trend was found during the later period (2005-2020:0.76).

The Co-Authorship Index for single authors shows a fluctuating trend. On the other hand, the Co-Authorship Index for multiple authors increased from 82.89 in the year 1989 to 107.54 in the year 2020, which indicates that the pattern of co-authorship was increasing among the contributions of the publications.

Table -3



**Single Vs Multiple Authored, Co-Authorship
Index Research Output and Degree of Collaboration**

year	Single Author		Multiple Author		Total	%	Degree of Collaboration	Mean in Degree of Collaboration
	No of Output	CAI	No of Output	CAI				
1989	12	157.22	15	82.89195	27	0.51	0.56	
1990	20	191.21	17	83.74855	37	0.7	0.46	
1991	45	174.93	46	82.74895	91	1.72	0.51	
1992	27	98.46	70	86.80083	97	1.83	0.72	
1993	54	175.25	55	88.81021	109	2.06	0.5	
1994	39	149.96	53	88.89602	92	1.74	0.58	0.61
1995	33	117.91	66	90.51231	99	1.87	0.67	
1996	31	100.61	78	89.0408	109	2.06	0.72	
1997	41	134.29	67	94.02464	108	2.04	0.62	
1998	43	137.04	68	94.84129	111	2.1	0.61	
1999	55	134.18	90	91.68319	145	2.74	0.62	
2000	54	152.82	71	94.81798	125	2.36	0.57	
2001	66	166.76	74	96.59453	140	2.65	0.53	
2002	51	133.64	84	95.45683	135	2.55	0.62	
2003	51	108.68	115	94.51896	166	3.14	0.69	
2004	47	100.76	118	99.05269	165	3.12	0.72	
2005	73	147.56	102	93.01158	175	3.31	0.58	
2006	49	105.05	116	100.6645	165	3.12	0.7	
2007	46	107.05	106	98.17998	152	2.87	0.7	
2008	63	108.71	142	100.7514	205	3.87	0.69	
2009	66	126.2	119	99.51047	185	3.5	0.64	
2010	51	98.58	132	99.94594	183	3.46	0.72	
2011	44	77.05	158	103.5909	202	3.82	0.78	
2012	63	98.61	163	103.9679	226	4.27	0.72	
2013	63	91.34	181	106.6016	244	4.61	0.74	
2014	47	75.57	173	105.9334	220	4.16	0.79	
2015	48	65.56	211	105.1823	259	4.89	0.81	
2016	57	73.32	218	105.9017	275	5.2	0.79	
2017	39	58.71	196	107.9656	235	4.44	0.83	
2018	26	38.48	213	106.9497	239	4.52	0.89	
2019	39	55.63	209	107.4878	248	4.69	0.84	
2020	53	58.04	270	107.5467	323	6.1	0.84	
Total	1496		3796		5292	100		0.68

It can be observed from Table 4 that the year 1989 had a Collaborative Index value of 3.37 and 1990 had an Index value of 2.41, 1991 had an index value of 3.23, and 1992 had an index value of 3.75.

Table 4
Collaborative Index in Nuclear Physics
Research Output

S. No	Publication Year	Publication	No. of Authors	CI
1	1989	27	91	3.37
2	1990	37	89	2.41
3	1991	91	294	3.23
4	1992	97	364	3.75
5	1993	109	484	4.44
6	1994	92	351	3.82
7	1995	99	536	5.41
8	1996	109	373	3.42
9	1997	108	438	4.06
10	1998	111	451	4.06
11	1999	145	606	4.18
12	2000	125	484	3.87
13	2001	140	559	3.99
14	2002	135	586	4.34
15	2003	166	893	5.38
16	2004	165	684	4.15
17	2005	175	791	4.52
18	2006	165	807	4.89
19	2007	152	938	6.17
20	2008	205	1155	5.63
21	2009	185	933	5.04
22	2010	183	1086	5.93
23	2011	202	1298	6.43
24	2012	226	1775	7.85
25	2013	244	1483	6.08
26	2014	220	1319	6
27	2015	259	1986	7.67
28	2016	275	2325	8.45
29	2017	235	1977	8.41
30	2018	239	2037	8.52
31	2019	248	2159	8.71
32	2020	323	3336	10.33



There are fluctuations in the number of Collaborative Index values during the study period. The highest Collaborative Index value of 10.33 was observed in the year 2020. The overall ‘Collaborative Index’ is 5.45. It shows the popularity of collaborative research patterns over single-author research in a chosen field of Nuclear Physics.

Major Findings

1. Nuclear Physics publications increased rapidly during the study period, most notably from 2011 to 2020. In total Nineteen thousand three hundred and sixteen authors have contributed a total of 5292 articles.
2. Author “Hatanaka K” published the highest number of articles for the study period with 52 publications and also had the highest citation score of 1023. The following authors “Tamii A” published the next highest citation number of articles for the study period with 51 records and also had the next highest citation score of 1002.
3. Single-author contributed papers constitute 31.97% of the publications whereas the remaining majority 68.03% of the papers are contributed by multi-authorship.
4. The degree of collaboration $C=0.68$ i.e., 68 percent of collaboration authors articles are published during the study period.
5. The pattern of co-authorship is increasing among the contributions.
6. There are fluctuations in the Collaborative Index value during the study period.

Conclusion

This study is reflected the author's productivity in Nuclear Physics research publications as seen in the Web of Science database. During the study period, the number of publications in Nuclear Physics has increased rapidly. The multiple-authored publication is very high compared with single-authored publication.

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5. **ABBREVIATIONS:-** CAI- Co-Authorship Index, CI- Collaborative Index, TLCS – Total Local Citation Score, TGCS – Total Global Citation Score, TLCR - Total Cited Reference