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Scientometric Tools and Technique Tested from Nanophysics Research Publication: A Global Perspective

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Abstract

This paper indicates the growth and development of publications of Nanao physics during the period of 2010-2017.1914 records collected through Web of Science. The highest productive journal in this field is the Journal of Applied Physics. In the authorship pattern, the top-ranked position is Wang H with 14 records. The publication level is high in the year 2012 with 514 papers. Chinese Academic Science was. The USA is the most top collaborative country with 495 records, and most of the articles are published in the English language. The most prolific single authors with 199 papers were in the year 2011 and multi authors in the year 2012 with 499 records. In this article Bradford law, Price square root law, and Pareto principles are applied. In the Bradford law, the core zone of the journal, 2 articles covered 714 articles and second zone 24 journals included in 616 articles and 393 journals covered 584 articles.

Keywords: Publication Productivity, NanoPhysics, Scientometrics

Introduction

Nanophysics is the branch of science. The word nano is derived from Greek word Nanos, meaning Dwarf. The prefix of this word used to describe one billionth of something. One nanometre is about eight times the radius of an atom and 100 times smaller than a bacterial cell. The function of nanophysics is to connect scientists with different interdisciplinary projects and incorporate the theory and methodology of other fields into their work. Nanoscience and nanotechnology are all about relating and exploiting phenomena for materials having one-two and three-dimension reduced to the nanoscale.The evolution of nanaophysics is from the early to mid 1980's. "Their evolution may be traced to three exciting happenings that took place in a short span from the early to mid-1980s with the award of Nobel prizes to each of them. These were: (i) the discovery quantum Hall effect in a two-dimensional electron gas; (ii) the invention of scanning tunnellingmicroscopy (STM); and (iii) the discovery of fullerene as the new form of carbon".

Literature Review

(Gopikuttan & Aswathy, 2014) Evaluated this study of publication productivity of the University of Kerala from 2000 to 2012. Web of science was used for data collection 1068 records were received. One thousand sixty-eight records collected for the study. (M, Sadik Batcha 2018) Analyzed the research output on oral cancer in India during the period of 2010-17.2606 records are collected from Web of Science. In this research output, India's rank was 4th. Chaturvedi and Nagini are the most productive authors in India. (Gupta, Dhawan & Gupta, 2017) Attempted to study the global publication on mobile cloud computing research .3779 publications are collected from SCOPUS database during the period 2006-17. China was a highly productive country in this field. (Arya et al.)This study evaluates the publication productivity of Malaysian researchers from June 1995 to June 2015.SCOPUS database used for the collection of data, and 180797 are collected. (Gupta, B M & Dhawan S M, 2017) Was analyzed his study was to identify the highly cited papers published in computer science by India during the period from 1996-2015. The data screened from SCOPUS database and 104715 citations have received. Total of 406 highly cited articles found in this study. (Sagar, Kademani, & Bhanumurthy, 2013) Evaluate the study of Agriculture Research publications in India during the period 1993-2012. For this study, data collected from the Web of Science. The objective of the study was to perform a scientometric analysis of all agriculture research publications by Indian scientists. (Waila, Singh, & Singh, 2016) Attempted to study the research in recommender systems during the period from 1992-2015. The study of this purpose data was collected from Web of Knowledge. (Vivekanandhan, Sivasamy, & L, 2016) the study of Pollution control research output in India and its evaluation for the period of 2003-2014. Scopus database retrieved for this purpose of data collection.28445 articles downloaded from Scopus database. (Vezyridis & Timmons, 2016) tried to identify publication and citation trends, most productive institutions and countries, top journals, most cited articles, and authorship networks from articles that used and analyzed data from primary care databases (CPRD, THIN, Q Research) of pseudonymized electronic health records (EHRs) in UK.

Objectives:-

1. To find out the most favored journals.
2. To find out the Relative Growth Rate and Doubling Time.
3. To find out the Authorship pattern.

4. To find out the Degree of Collaboration.
5. To find out the Collaborative Coefficient, Collaborative Index, and Co-Authorship Index.
6. To find out the most productive Country and Institution.
7. To find out the Brad ford Law
8. To analyze the Price Square Root Law and 80 * 20 rules.

Methodology

This study analyzed the growth and development of the publication productivity of Nano Physics.The data for this study was downloaded from Web of Science. The study covered a period from eight years from 2010 to 2017 — total 1914 data retrieved from the Web of Science. Hitcite software applications are using for the analysis of the data and also analysis MS Excel for analysis. Bibliometric/Scientometric indicators were applied for the study, Authorship pattern, Degree of collaboration, and Bradford Law, Price's Square Root Law & Paretto Principle are using for this study.

Table 1: Authorship Pattern

Sl.No.	Author	Records	Percent	LCS	LCS/t	LCSx	GCS	GCS/t	LCR	LCSb
1	Wang H	14	0.7	0	0	0	163	27.90833	0	0
2	Sato K	11	0.6	0	0	0	51	8.440476	0	0
3	Li M	9	0.5	0	0	0	383	61.27381	2	0
4	Wang J	9	0.5	0	0	0	56	21.85714	0	0
5	Wang Q	9	0.5	0	0	0	137	23.07381	0	0
6	Lee H	8	0.4	0	0	0	44	7.307143	0	0
7	Li X	8	0.4	0	0	0	226	72.5	1	0
8	Liu J	8	0.4	0	0	0	61	15.06667	0	0
9	Katayama-Yoshida H	7	0.4	0	0	0	33	4.821429	0	0
10	Wang L	7	0.4	0	0	0	78	14.00952	0	0
11	Wang Y	7	0.4	0	0	0	172	27.33333	0	0
12	Zhang H	7	0.4	0	0	0	103	21.47619	0	0
13	Zhang Y	7	0.4	0	0	0	60	14.04286	0	0
14	Kim H	6	0.3	0	0	0	83	25.20952	0	0
15	Kim J	6	0.3	0	0	0	67	11.9	0	0
16	Kim M	6	0.3	0	0	0	44	8.7	0	0
17	Kumar S	6	0.3	0	0	0	97	28.04762	0	0
18	Lee J	6	0.3	0	0	0	17	5.028571	0	0
19	Sato K	6	0.3	2	0.4	2	580	139.6333	1	0

20	Liu Y	6	0.3	0	0	0	58	15.5	0	0

Figure 1: Authorship Pattern
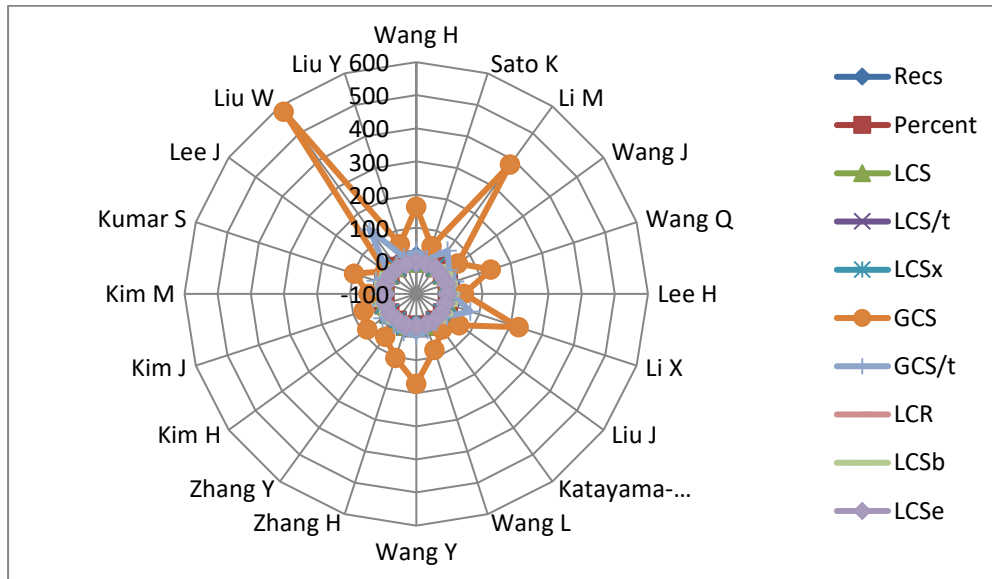
The table shows that the author wise distribution of records published on Nanophysics, Wang H was the top position with 14 articles. The second position is Sato K, with 11 articles. In this top 20 records, the author named Sato K 's file Science as a local level and also the highest global cited the author. The author's contribution is below one percent.

Table 2: Degree of Collaboration

Sl.No.	Year	Single Authored paper (NS)	Multi-Authored Paper (NM)	Total (NM+NS)	Degree of Collaboration
1	2010	11	145	156	0.929
2	2011	19	317	336	0.943
3	2012	15	499	514	0.970
4	2013	16	250	266	0.944
5	2014	9	130	139	0.935
6	2015	11	147	158	0.929
7	2016	12	153	165	0.921
8	2017	17	163	180	0.888
		110 (5.75%)	1804 (94.25%)	1914 (100%)	7.459(0.932)

Figure 2: Degree of Collaboration
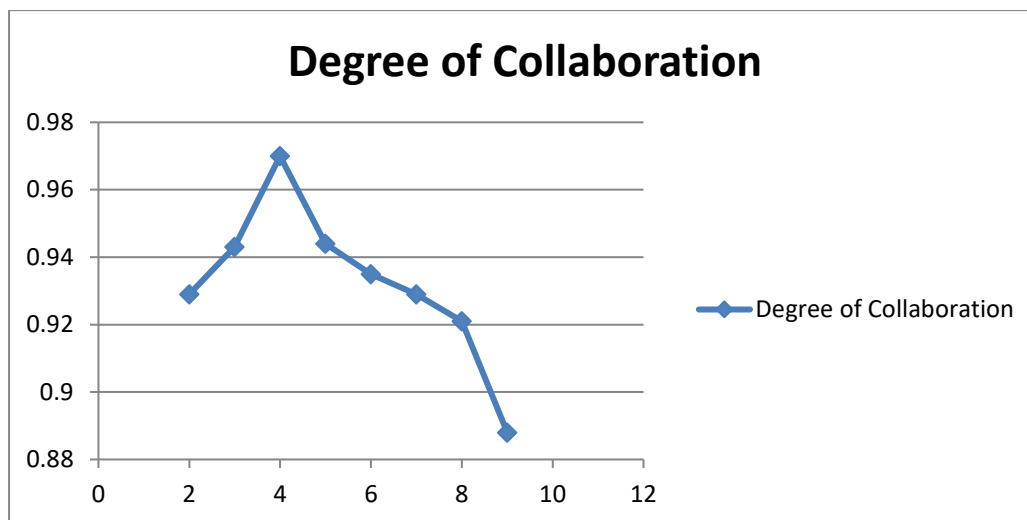
Table 3: Collaborative Index

Sl. No.	Year	Number of Authorship pattern										Total Authors Article	Total Article	C.I
		1	2	3	4	5	6	7	8	9	10 & above			
1	2010	11	17	32	30	18	15	7	9	8	9	732	156	4.69
2	2011	19	38	70	49	48	47	23	12	13	17	1567	336	4.66
3	2012	15	68	87	101	69	54	41	28	17	34	2148	514	4.18
4	2013	16	53	34	41	38	24	18	12	11	20	1206	266	4.53
5	2014	9	23	20	24	18	19	7	7	4	8	636	139	4.57
6	2015	11	15	26	29	26	12	12	9	7	11	766	158	4.85
7	2016	12	20	30	27	23	16	12	8	4	12	757	165	4.59
8	2017	17	33	32	24	23	19	9	8	2	13	779	180	4.32
Total		110	267	331	325	263	206	129	93	66	118	8591	1914	36.22
Percentage		5.77	13.95	17.29	16.98	13.74	10.76	6.74	4.89	3.45	6.19		100	Mean 4.53

Table 4: Co Authorship Index & Collaborative Co- efficient

| Sl. No.	Year	Number of Authorship pattern										Total Article	CC	CAI
		1	2	3	4	5	6	7	8	9	10 & above			
1	2010	11	17	32	30	18	15	7	9	8	9	156	0.694	122.80
2	2011	19	38	70	49	48	47	23	12	13	17	336	0.706	100.00
3	2012	15	68	87	101	69	54	41	28	17	34	514	0.726	50.88
4	2013	16	53	34	41	38	24	18	12	11	20	266	0.696	105.31
5	2014	9	23	20	24	18	19	7	7	4	8	139	0.691	114.00
6	2015	11	15	26	29	26	12	12	9	7	11	158	0.707	122.80
7	2016	12	20	30	27	23	16	12	8	4	12	165	0.695	126.31
8	2017	17	33	32	24	23	19	9	8	2	13	180	0.657	164.91
Total		110	267	331	325	263	206	129	93	66	118	1914		

This table shows that the value of CC varies from discipline to discipline, and the lowest CC is 0.657 in 2017 and the highest in 0.726 in 2012. The fluctuations are seen in the collaborative coefficient. The Co-Authorship Index was the highest in 2017; it was 164.91. The mean value of Degree of Collaboration is 0.932. Total single author 110 (5.75%) contributed to this field, and .95% of the total publications are provided by Multi authors.

Table 5: Year-wise Distribution

Sl.No.	Publication Year	Recs	Percent	LCS	GCS
1	2010	156	8.2	12	4398
2	2011	336	17.6	6	6333
3	2012	514	26.9	2	7738
4	2013	266	13.9	6	4623

| 5	2014	139	7.3	5	2362
6	2015	158	8.3	4	1937
7	2016	165	8.6	1	1299
8	2017	180	9.4	0	575

Figure 3: Year-wise distribution
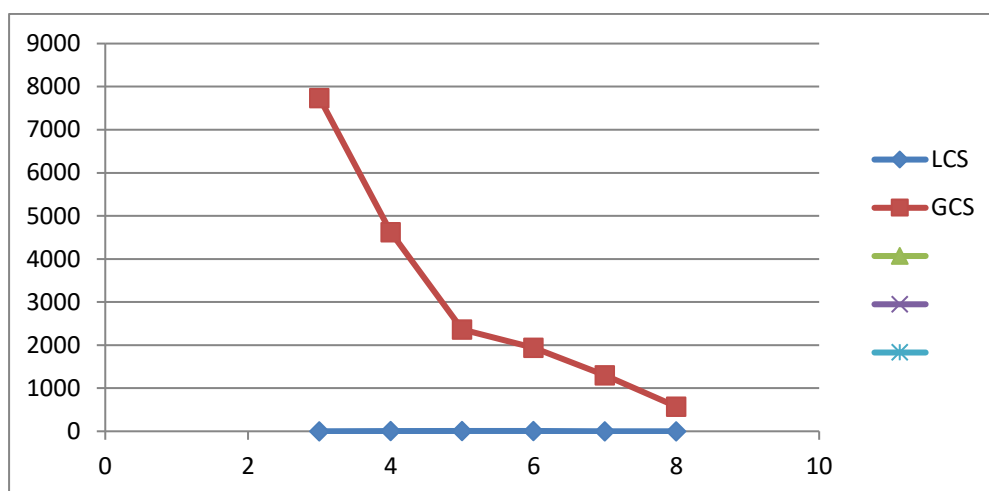
A total 1914 records published in the field of nanophysics during this period. The top-ranked article published in the year 2012 (26.9%) and also the highest number of citations received in the year 2012. Twenty-eight thousand nine hundred ninety citations received under this study. The lowest publication was in the year 2014 with 139 records (7.3%). The year-wise growth of research output by the authors of Nanophysics is presented in Table 5.

Table: 6 Relative Growth Rate and Doubling Time

Sl.No.	Year	No. of Articles	Cumulative no. of Articles	W1	W2	RGR	Dt.
1	2010	156			5.049		0.693
2	2011	336	492	5.049	6.198	1.149	0.603
3	2012	514	1000	6.198	6.913	0.715	0.969
4	2013	266	1272	6.913	7.148	0.235	2.948
5	2014	139	1411	7.148	7.252	0.104	6.663
6	2015	158	1569	7.252	7.358	0.106	6.538
7	2016	165	1734	7.358	7.458	0.1	6.93
8	2017	180	1914	7.458	7.556	0.098	7.071

Figure: 4: Relative Growth Rate
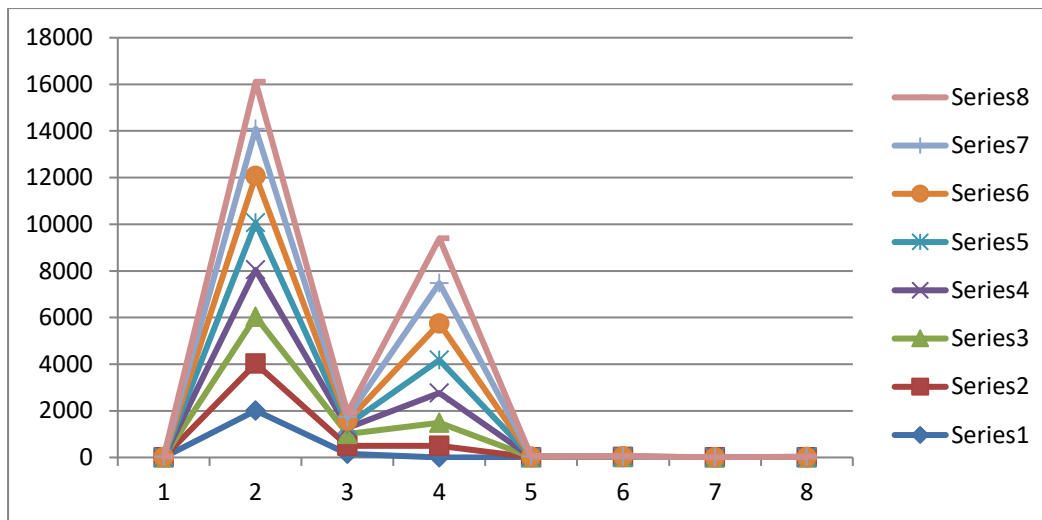
Relative Growth Rate is the increase in several articles or pages per unit of time. The mean RGR throughout the interval can be calculated from the following equation.

$$R(1\text{-}2) = \frac{W2\text{-}W1}{T2\text{-}T1}$$

Where 1-2 is the mean relative growth rate over the specific period of interval. W1 is the log of the initial number of articles; logW2 is the log of the final number of articles after a specific period of interval and T2-T1 is the unit difference between the initial time and the final time,

Doubling Time (Dt) = 0.693/R

In this table, the Relative Growth Rate is changing mode, but in the Doubling Time is increasing each year.

Table 7: Journal of wise Distribution

Sl. No.	Journal	Recs.	Percent	LCS	LCS/t	GCS	GCS/t	LCR
1	JOURNAL OF APPLIED PHYSICS	400	20.9	0	0	5230	845.4262	2
2	APPLIED PHYSICS LETTERS	314	16.4	0	0	6232	994.6929	4
3	JAPANESE JOURNAL OF	215	11.2	0	0	928	191.3202	0

	APPLIED PHYSICS						
4	JOURNAL OF CHEMICAL PHYSICS	53	2.8	0	0	655	109.4833	1
5	APPLIED PHYSICS EXPRESS	45	2.4	0	0	720	138.2571	0
6	REVIEW OF SCIENTIFIC INSTRUMENTS	44	2.3	0	0	525	89.14762	2
7	CHINESE JOURNAL OF CATALYSIS	40	2.1	2	0.583333	506	175.4	2
8	SCIENTIFIC REPORTS	30	1.6	0	0	531	151.5667	0
9	JOURNAL OF ENERGY CHEMISTRY	20	1	2	0.666667	135	66.66667	2
10	NATURE COMMUNICATIONS	16	0.8	0	0	432	126.75	1
11	ACTA PHYSICA SINICA	15	0.8	0	0	15	5.7	0
12	PHYSICS OF PLASMAS	15	0.8	0	0	113	18.09405	0
13	JOVE-JOURNAL OF VISUALIZED EXPERIMENTS	14	0.7	0	0	63	12.27619	0
14	NEW JOURNAL OF PHYSICS	13	0.7	0	0	154	39.35	0
15	JOURNAL OF PHYSICS D-APPLIED PHYSICS	12	0.6	0	0	226	82.95	2
16	BIOMICROFLUIDICS	11	0.6	0	0	801	107.625	0
17	ACS NANO	9	0.5	0	0	249	110.75	0
18	JOURNAL OF PHYSICS-CONDENSED MATTER	8	0.4	0	0	127	43.81667	1
19	NANOSCALE	8	0.4	1	0.25	326	88.43333	1
20	PHYSICAL REVIEW B	8	0.4	0	0	217	34.68571	0

This table shows that the journal wise distribution Journal of Applied Physics is the highest record with 400 articles. It is 21% of the total journal score. The global citation of this journal is 5230, and local citation is nill. The second position is Applied Physics Letters, with 314 records. Most of the journals are not cited at a local level. In this top 20's journals, Chinese Journal of catalysis, Journal of Energy Chemistry, and nanoscale are the only three journals are cited as a local level.
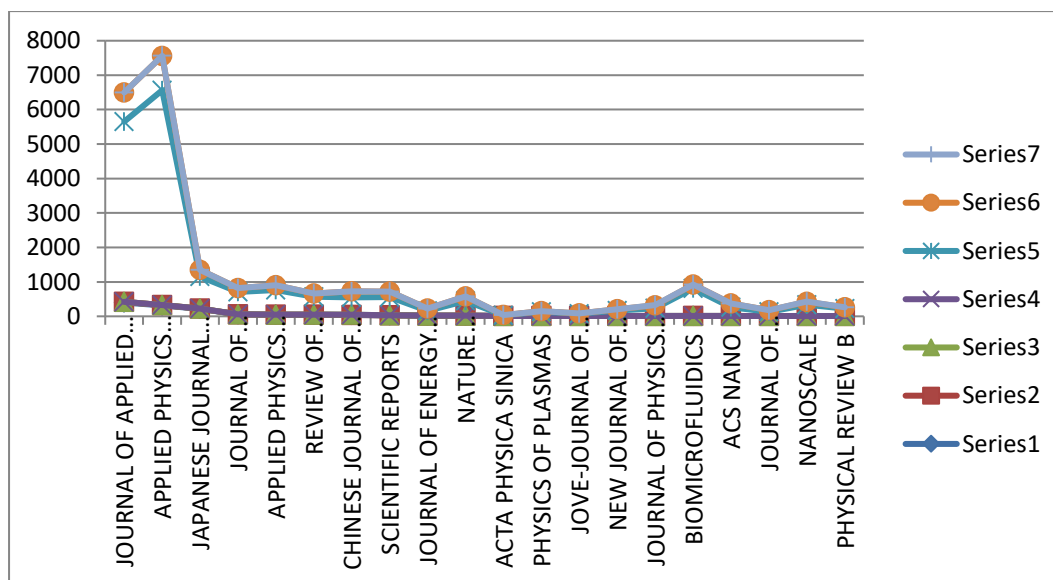
Figure: 5: Journal wise Distribution

Table 8: Institution wise Distribution

| Sl. No.	Institution	Recs.	Percent	LCS	GCS
1	Chinese Acad Sci	78	4.1	1	1168
2	Osaka Univ	39	2	0	326
3	Tohoku Univ	36	1.9	0	294
4	CNRS	35	1.8	4	1000
5	Tsinghua Univ	32	1.7	1	463
6	Univ Tokyo	30	1.6	0	319
7	Indian Inst Technol	21	1.1	0	329
8	MIT	21	1.1	0	750
9	Nanyang Technol Univ	19	1	0	253
10	Peking Univ	19	1	0	334
11	Univ Illinois	19	1	0	430
12	Natl Chiao Tung Univ	18	0.9	0	139
13	Argonne Natl Lab	16	0.8	0	204
14	Japan Sci & Technol Agcy	16	0.8	0	156
15	Natl Inst Adv Ind Sci & Technol	16	0.8	0	246
16	Natl Univ Singapore	16	0.8	0	500
17	Seoul Natl Univ	16	0.8	0	411
18	Univ Calif Berkeley	16	0.8	1	926
19	Natl Inst Mat Sci	15	0.8	0	302
20	Kyoto Univ	14	0.7	0	130

Figure 6: Institution Level
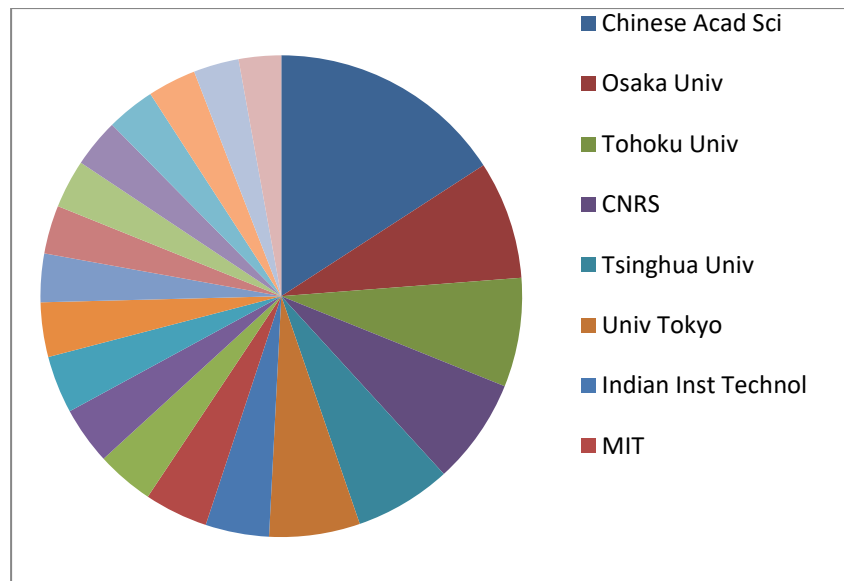
As seen from the publication data of Nanophysics during the period from 2010-2017, the institution of Chinese Academic Science was the top-ranked at the institution level. The second position in Osaka Univ. Some of the institutions are not cited at a local level. The percentage of the contribution of each institution in this field is below 5%. The most global mentioned institution is Chinese Academic Science, and lowest level is Kyoto University

Table 9: Country-wise Distribution

Sl. No.	Country	Records	Percent	LCS	GCS
1	USA	495	25.9	16	10529
2	Peoples R China	372	19.4	6	5397
3	Japan	293	15.3	1	3111
4	France	154	8	6	3188
5	Germany	143	7.5	9	2751
6	South Korea	126	6.6	1	1839
7	UK	106	5.5	2	2606
8	India	104	5.4	0	1163
9	Taiwan	76	4	0	844
10	Italy	69	3.6	2	898
11	Australia	53	2.8	0	819
12	Switzerland	51	2.7	2	1345
13	Russia	49	2.6	1	535
14	Spain	44	2.3	1	1443
15	Canada	43	2.2	0	562
16	Singapore	40	2.1	0	737
17	Iran	39	2	0	353

| 18 | Israel | 32 | 1.7 | 0 | 472 |
| 19 | Sweden | 30 | 1.6 | 0 | 860 |
| 20 | Netherlands | 28 | 1.5 | 0 | 538 |

Figure 7 : Country wise Distribution
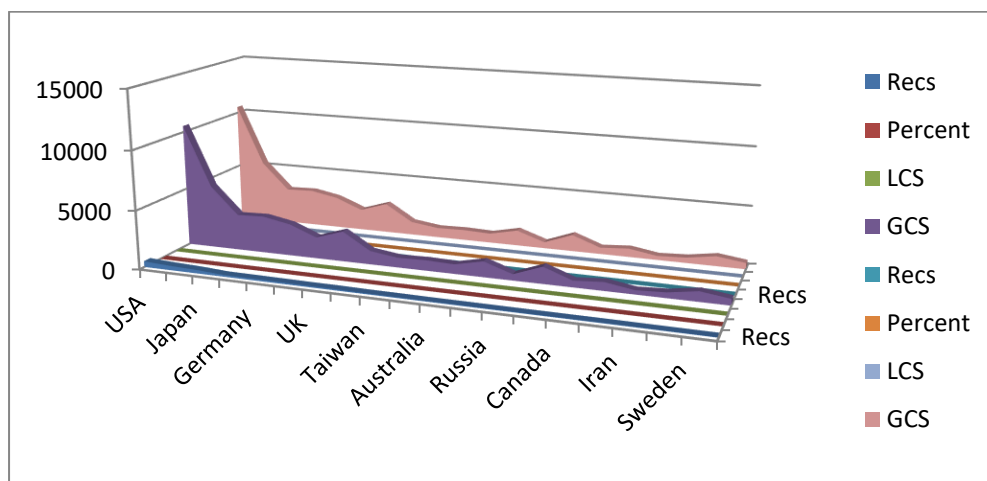
Out of 77 countries, the USA was the highest collaborative country with 495 records and 10529 citations. The second position was Peoples Republic Chine, with 372 papers. Publication productivity is very low in Israel, Sweden, and the Netherlands; it is below two percent. In these publications, some of the articles are not cited as a local level. India rank is in 8th position, and it is only 5.4% of the total productivity. The materials in India are not cited at a local level, but the global citation is 1163.

Table 10: Language wise distribution

Language	Recordss	Percent	LCS	GCS
English	1888	98.6	35	29221
Chinese	23	1.2	1	44
Russian	1	0.1	0	0
Spanish	1	0.1	0	0
Turkish	1	0.1	0	0

Figure:8: Language wise Distribution
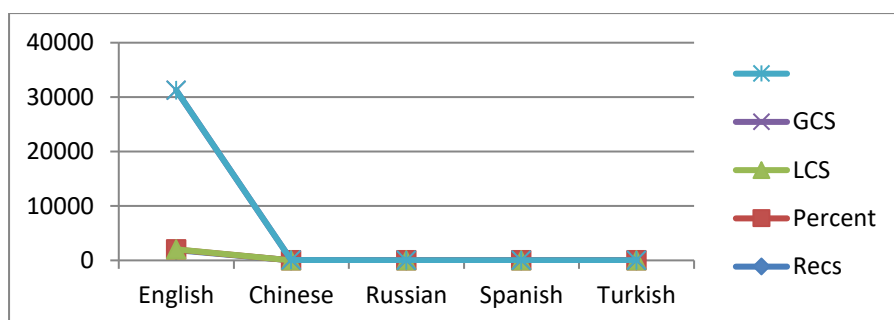
This table analyses the languages in which the researchers communicate in the subject of Nano-Physics. Overall, five words identified, in which English is top in this list with 1914 records. The highest local and global cited language is also English, followed by Chinese. Russian, Spanish, and Turkish was the less contribution in this field.

Table 11: Bradford Law

Sl. No.	No. of Journals	No. of records output	Total no. of records output	Cumulative no. of records output
1	1	400	400	400
2	**1**	**314**	**314 (714)**	714
3	1	215	215	929
4	1	53	53	982
5	1	45	45	1027
6	1	44	44	1071
7	1	40	40	1111
8	1	30	30	1141
9	1	20	20	1161
10	1	16	16	1177
11	2	15	30	1207
12	1	14	14	1221
13	1	13	13	1234
14	1	12	12	1246
15	1	11	11	1257
16	1	9	9	1266
17	4	8	32	1298
18	2	7	14	1312
19	**3**	**6**	**18 (616)**	1330
20	7	5	35	1365
21	17	4	68	1433
22	22	3	66	1499
23	68	2	136	1635

24	**279**	**1**	**279(584)**	1914	

Zone	No. of Articles	No. Journals
Zone 1	714	2
Zone 2	616	24
Zone 3	584	393

This table shows that in the first zone covered 2 journals, 24 journals covered the second zone, and remaining 393 journals included in the third zone. The Bradford multiplier is 2. Hence the study does not apply the Bradford Law.

Table 12: Price's Square Root Law & Paretto Principle

Sl.No.	No.of Contributors A	No.of Contributions B	% of 1914	Total No. of Contributors A * B	Cumulated A * B	Accumulated % of A * B
1	44	1	0.005	44	44	0.48
2	25	1	0.005	25	69	0.27
3	22	1	0.005	22	91	0.24
4	20	2	0.104	40	131	0.43
5	19	1	0.005	19	150	0.21
6	18	2	0.134	36	186	0.39
7	16	3	0.167	48	234	0.52
8	15	7	0.368	105	339	1.14
9	14	13	0.679	182	521	1.98
10	13	10	0.524	130	651	1.41
11	12	9	0.470	108	759	1.17
12	**11**	**25(75)**	**1.306**	**275**	**1034**	**2.99(11.23)**
13	10	45	2.351	450	1484	4.89
14	9	66	3.448	594	2078	6.46
15	8	90	4.704	720	2798	7.83
16	7	129	6.740	903	3701	9.82
17	6	206	10.763	1236	4937	13.44
18	5	264	13.793	1320	6257	14.35
19	4	323	16.876	1292	7549	14.05
20	3	334	17.49	1002	8551	10.89
21	2	266	13.898	532	9083	5.78
22	1	116	6.165	116	9199	1.26
23	284	1914	100	9199		100%

This table shows that 75 (nearly Square Root Value of 9199) contributors are located in 11.23% of the total publications. It means 75 authors contributed 11.23% of the value. This value is far away from 50% (half of the literature publication).Hence the result is not matched with price square law. 20% of the total authors is 1840. In 80 * 20 rule the value should not be close to 80 percentages. Hence it is concluded that this result is not in compliance with Pareto Principles.

Price Square Root of 9199 = 96

20% of the total value in 1840.

Conclusion

In this study of the Nanophysics from 2010 to 2017 based on the Web of Science, 1914 articles published during this period. The USA was the most collaborative country with India. In country-wise distribution, India's rank was the 8th position with 104 records. Topmost productive Institution is the Chinese Academy of Science. Most of the articles are published in the English language. Journal of Applied Physics is the highest prolific journal in this field. Doubling time 7.07 is in the year 2017. In these articles, the Bradford law is not satisfied. In the price square root law shows that 11.23% of the total article is contributed. In the Pretto Principles, the rule is not constant.

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