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Scientometric Analysis of Research Productivity of Jadavpur University in Physics (1990-2019)

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In this article the researchers have taken up a scientometric method to explore the research performance of the Jadavpur University in the scientific discipline of Physics. The main objective of the study is to determine the research productivity over a 30-years period (1990-2019), as well as the number of citations, collaborations, and authorship trends that have taken place. The bibliographic and citation data were obtained from the Scopus database. Scientometric techniques and software, such as, Bibliometrics package of R environment as well as VoSViewer were used to analyze the data. The conclusions indicate that the faculty members' research productivity is growing in a linear pattern, while their publications are receiving more citations, and their journals have a higher and profound Impact Factor. It is basically to explore the co-authorship pattern, co-occurrence of keywords and co-citation network as well. It is also observed that the Jadavpur University researchers have produced significant research articles through the collaboration of foreign researchers and thereby expanded inter-disciplinary studies.

Keywords: *Jadavpur University, Physics, Scientometric, Co-authorship collaboration, Citation analysis, Co-citation link*

0 INTRODUCTION

Any university that conducts research on any topic while keeping up with current events throughout the world has a risk-taking capacity which is required for great research. Every academic institution's culture should encourage and support taking on challenging projects. Scientific research entails the collaboration and coordination of various individuals in order to attain goals

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that have societal implications and are obligatory for general progress in all domains. Any institution's reputation and credibility are inextricably linked to its research productivity and influence. The research publications of an institute are furnished weightage by a variety of rating organizations and funding agencies. Through the usage of scientometric methods, the current study explores Jadavpur University's research success in physics. The Jadavpur University (JU) was established in 24th December, 1955 as the state aided public university by the then Government of West Bengal. Actually, this university started its journey before independence since 1905. The predecessor of this university was Bengal Technical Institute (later College of Engineering and Technology, Bengal) which was looked after by the National Council of Education, Bengal (NCE) till 1955. At present, JU has established itself as a leading university of India and has become a premier institution of advanced study and research work. In 2020, the National Institutional Ranking Framework has ranked it at 17 among the engineering institutes in India, 12 overall and 5th among universities.

It also ranked 136 in Asia in 2020 as per QS World University Rankings System. The Department of Physics at Jadavpur University was founded in 1956 and offers B.Sc. (Honors), M.Sc. Honors), M. Phil, and Ph. D programs. A Post M. Sc. Diploma course inMedical Physics has also been conducted by this department. It has already become a distinct center for the advanced study and research in both theoretical and experimental physics. The thrust areas of research activity are material science, condensed matter physics, biophysics, and particle physics. The first publication on physics entitled 'Note on a Direct Method of Solving Problems of Elastic Plates with Circular Boundaries having prescribed displacement' for Jadavpur University was made by Bibhuti Bhusan Sen in 1957. It was published in the journal Zeitschrift für angewandte Mathematik und Physik (ZAMP), volume 8, no. 4; p. 307-309.

Scientometric analysis focuses on revealing the internal structure of intellectual domains, which include mapping the components of disciplines, fields, or specialties on the basis of evidence from the literature under study. The scientometric perspective adds a quantitative focus on texts and communication to the inter-disciplinarity of science and technology studies.

Previously, several papers reported the use of quantitative methods, such as, bibliometric/scientometric to examine the research performance of educational institutions in various disciplines. There have been several notable studies on assessing research output (across many disciplines) in relation to an institute such as Jeevan and Gupta[1] (2002), Mehta[2] (2005), Alibeygi[3] (2008), Kumbar et al.[4] (2008), Bala and Gupta[5] (2009), Mishra[6] (2010), Jeyshankar et al.[7] (2011), Kaur et al.[8] (2011), Baby and Kumaravel[9] (2012), Savanur and Konnur[10] (2012), Kumar and Dora[11] (2012), Sudhier and Priyalakshmi[12] (2013), Maharana and Sethi[13] (2013), Visakhi and Gupta[14] (2013), Wani et al.[15] (2013),

Chaurasia and Chavan[16] (2014), Gopikuttan and Aswathy[17] (2014), Leema[18] (2014), Gautam and Mishra[19] (2015), Jeyshankar[20] (2015), Siwach and Kumar[21] (2015), Tripathi and Kumar[22] (2015), Mandhirasalam[23] (2016), Haq and Fouzan[24] (2017), Naika[25] (2017), Nandi and Mondal[26] (2017), Kumar[27] (2018), Mondal and Raychoudhury[28] (2018), Mulimani and Hadagali[29] (2018), Bhakta and Bhui[30] (2018).

There are some studies that look at the productivity patterns of many academic institutions at a glance, such as Dhawan and Gupta[31] (2007), Sevukan and Sharma[32] (2008), Husian and Muzamil[33] (2011), Abilash[34] (2012), Lee et al.[35] (2012), Bala and Kumari[36] (2013), Pandita et al.[37] (2014), Visakhi et al.[38] (2015), Satpathy and Sa[39] (2015), Sangeeta[40] (2016), Rosalin[41] (2016), Mukherjee[42] (2017), Guskov et al.[43] (2018), Pradhan and Ramesh[44] (2018), Mohan and Kumbar[45] (2020).

Just a few reports have looked at a single academic institution's publication output in a specific subject area, such as Kademani et al.[46] (2005), Girap et al.[47] (2009), Hadagali et al.[48] (2009), Sarkhel and Raychoudhury[49] (2010), Sudhir[50,51] (2010, 2011), Upadhye et al.[52] (2012), Nongrang and Laloo[53] (2016), Khanna et al.[54] (2017), Nagarkar and Kengar[55] (2017).

A majority of the research looked at either several institutes with multiple disciplines or a single institute with multiple disciplines. Many of these studies based their reviews on easily available bibliographic databases or citation indices (Scopus and/or Web of Science/Indian Citation Index/Google Scholar) or based on thesis literature.

In this article, they have taken up the scientometric method to explore the research performance of the Jadavpur University in Physics discipline. This study is diverse from other previous studies in terms of data source, period covered and application of quantitative indicators as well.

1 RESEARCH QUESTIONS

We framed the following questions to recognize the basic objectives of this study:

- What has been JU's performance in physics study over time?
- What are the documents type distribution of the publication?
- How is the scientometric profile of prolific researchers?
- What effects do publication sources have?
- What are the most important effective organizations and nations, as well as the extent of their collaborations?
- How is the dynamics of keywords and thrust area of research?
- What are the outcomes of citation analysis?

2 METHODOLOGY

On December 18, 2020, the bibliographic data was obtained from Scopus database of the Elsevier using the affiliation IDs provided by Scopus to the various institutions. The 'affiliation search' was conducted with the first keyword 'Jadavpur University,' and then the search was narrowed down to the years 1990 to 2019. When all of Jadavpur University's publications were discovered, the 'Subject Area' tag was further narrowed down to 'Physics and Astronomy.' As a result, a total of 5949 publications were found. Using standard scientometric methods, the collected bibliographic and citation data were analyzed. They have used software tools, such as, Bibliometrics[56] package of R environment and VoSViewer[57] as well.

3 ANALYSIS AND DISCUSSION

PUBLICATION OUTPUT

In Jadavpur University, the number of overall publications is 24676 in all disciplines and those in the field of physics and astronomy consisted of 5949 publications, respectively during 1990-2019. During the period under study, the physics output accounted for 22.21 percent of JU's total output. From 2008 onwards, the publication has been on an upward trajectory. The publishing pattern is nearly linear between 1990 and 2019 following the equation $y = 12.77x + 0.275$ with $R^2 = 0.826$ as well (Figure-1). It can be seen from the analysis that the average annual growth rates (AAGR) are 6.51% and 12.12% for physics output during the decade 2000-2009 and for 2010-2019 respectively.

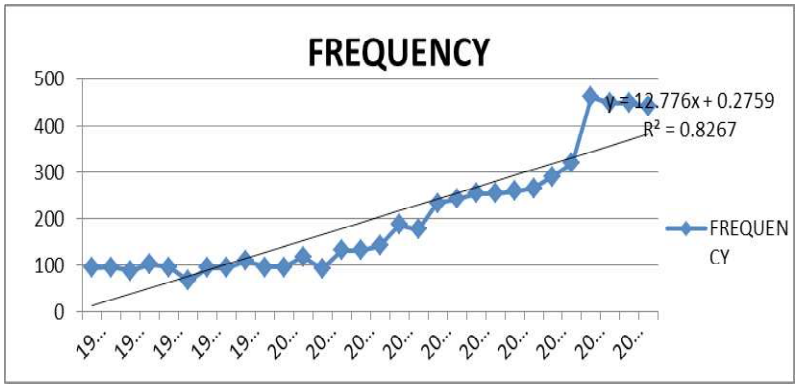

Fig. 1 Trends of Publications

We have also noticed that the average citation per paper registered by physics publications of JU was 11.61. The average citation per year per paper registered by physics publications of JU was 1.273.

DOCUMENTS TYPE DISTRIBUTION OF PUBLICATION

In order to gain exposure, it is imperative to realize what is published where and how it is published. A high-quality paper published in a well-known journal is immediately noticed by scientists and receives several citations, while an important paper published in a lesser-known journal can go unnoticed for years. Keeping with this viewpoint the whole publications were segregated according to their container that is document types (Table-1).

TABLE-1

31 Category of Document Types

SI No	Document Types	Frequency	% of share
1	Article	5013	84.26626
2	Conference Paper	804	13.51488
3	Reviews	60	1.008573
4	Book Chapter	32	0.537906
5	Erratum	11	0.184905
6	Letters	8	0.134476
7	Note	8	0.134476
8	Book	5	0.084048
9	Article in press	4	0.067238
10	Editorial	3	0.050429
11	Retracted	1	0.01681

From 1990 to 2019, a total of 5949 publications were written across 11 various document types.

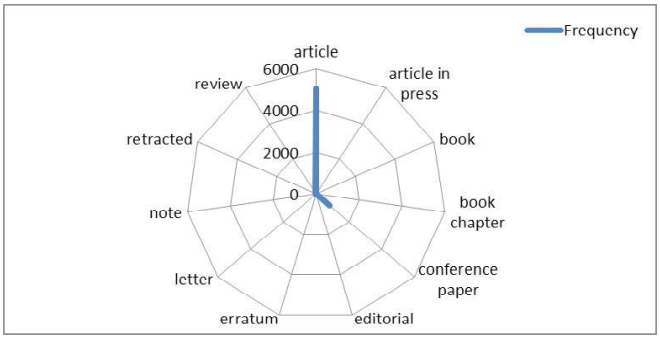

Fig. 2 Document Types

The most-frequently used document type (Figure-2) was article (5013; 84.26%), followed by conference papers (804; 13.51%), reviews (60; 1 %) and Book chapters (32; 0.53%). Erratum, Letters, Notes, Editorial materials, etc. were among the least significant categories.

DISTRIBUTION OF PUBLICATIONS IN TERMS OF COLLABORATION

Collaboration in scientific research is both important and complimentary to the internationalization and affirmation of findings. To improve the visibility and readability of the literature, academic disciplines are increasingly collaborating on research projects.

TOP COLLABORATING INSTITUTIONS

The University of Calcutta attained the first rank (254 papers) in case of most collaborating organizations with JU in physics, followed by Indian Institute of Engineering Science and Technology, Shibpur (203), Indian Association for the Cultivation of Science (173), Indian Institute of Technology Kharagpur (157), Central Glass and Ceramic Research Institute India (100), and so on. It is interesting to note that the ten most collaborative institutions are all located in India. Between 1990 and 2019, 1156 (19.43%) of the 5949 publications in physics by JU researchers featured international collaboration. Actually, JU researchers worked on studies with a large number of organizations and academics from 63 different countries, with the majority of papers coming from the United States of America (USA), the United Kingdom (UK), and Germany.

TOP COLLABORATING COUNTRIES

JU engaged on research with a huge number of organizations and academics from throughout the world. The majority of the papers (185) originated in the USA, followed by UK (97), Germany (95), Italy (54) and so on. It has found that about 12.71% papers were shared by the top ten most contributed foreign countries. Over the course of 20 years, the contribution of each country to collaboration ranged from 1 to 185 articles. It can be seen from the analysis that forty-six countries contributed fewer than 20 papers each, five countries contributed fewer than 30 papers each, three countries contributed fewer than 40 papers each, four countries contributed fewer than 50 papers each, three countries contributed more than 50 papers each and only one country contributed more than 100 papers respectively.

CO-AUTHORSHIP COLLABORATION (COUNTRY)

We set the “minimum number of documents for a country” to 10, leaving 66 countries in the network (Figure-3).

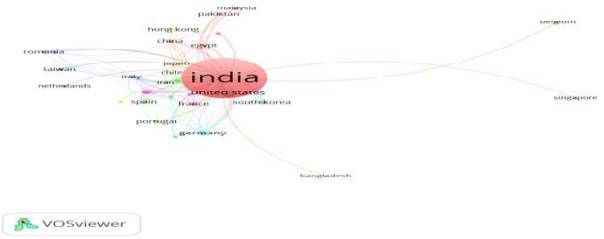

Fig. 3 Co-authorship Pattern (Country)

In terms of the number of publications or overall relation strength, the India and USA are first and second, respectively. UK, Germany, and Italy have all written more articles than the other nations, as shown by the wider nodes.

SCIENTOMETRIC PROFILE OF TOP TEN RESEARCHERS

Approximately a total 3823 researchers contributed to physics research in JU during 1990-2019. The average number of authors per document is 0.643 and average number of documents per author is 1.56. The scientometric profile of top 10 most productive researchers is given in Table-2.

TABLE-2

32 Profile of Prolific Researchers

S. No.	Author	Frequency	ACP	ACY
1	Chakraborty S	366	8.98	164.4
2	Das S	341	14.94	254.85
3	Ghosh D	288	9.56	137.75
4	Sarkar S	283	7.87	110.2
5	Rahaman F	247	13.94	172.2
6	Chattopadhyay K K	237	20	235
7	Sarkar C K	203	8.96	91
8	Chatterjee S	161	7.85	63.25
9	Deb A	161	7.24	58.3
10	Roy S	156	8.13	63.45

ACP = Average number of citations per paper; ACY = Average number of citations per year

The top ten most productive researchers produced 2443 papers and 27008 citations, accounting for 41% of all JU publications and 39% of total physics citations during the period under study. The most prolific researchers are S. Chakraborty accounting with 366 papers, followed by S Das (341 papers), D. Ghosh (288 papers), S. Sarkar (283 papers) and F. Rahaman (247 papers) respectively.

CO-AUTHORSHIP COLLABORATION (RESEARCHER)

The co-authorship collaborations among the most prolific researchers (published at least 50 papers and receive at least 50 citations) have been visualized by VOSviewer. The analysis shows only 65 researchers meet the threshold and connected to each other in order to create a co-authorship collaboration network (Figure-4).

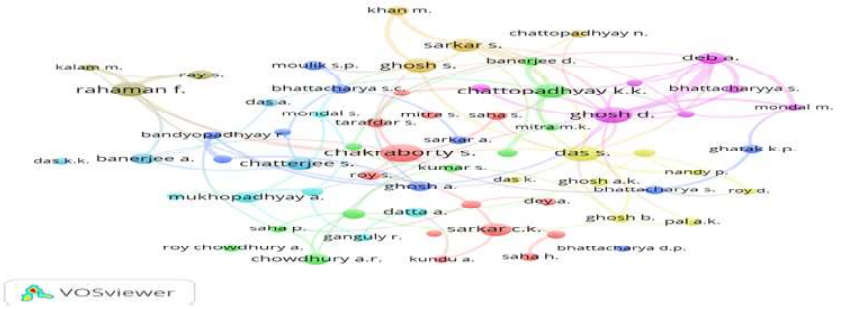

Fig. 4 Co-authorship collaboration (researcher)

It also displays that there are nine major clusters formed among researchers. The first cluster is constituted with 13 researchers (red), second one with 10 researchers (green), third one with 10 researchers (indigo), fourth one with 8 researchers (yellow), fifth one with 7 researchers (purple), sixth one with 6 researchers (sky blue), seventh one with 4 researchers (blue), eighth one with 4 researchers (brown) and ninth one with 3 researchers (pista) respectively. We can notice that S. Chakraborty, the researcher with the almost (362) publications and the overall correlation intensity (177), followed by S. Das with 294 publications and the total link strength with 286 are located in the map's very middle. It can be perceived from further analysis that the Co-authors per documents are 3.66 and collaboration index is 0.65 as well.

IMPACT OF SOURCES OF PUBLICATIONS

Out of the 5949 publications by published by JU in Physics, 5017 publications appeared in 574 journals that is an average of 8.79 papers published by each journal. Table-3 represents the data related to journal-wise distribution of papers and corresponding citation impact of the top twenty most sought journals. The maximum number of papers on Astrophysics and Space Science were published (108) with H-index (19), G-index (24), SJR (0.46), Impact Factor (1.43) and get 949 citations. This is followed by the International Journal of Theoretical Physics having 97 papers with H-index (13), G-index (22), SJR (0.32), Impact Factor (1.347) and get 669 citations; next one is Pramana - Journal of Physics having 74 papers with H-index (10), G-index (17), SJR (0.38), Impact Factor (1.688) and received 398 citations as well.

TABLE-3

Source	NP	H-index	G-index	SJR	IF
Astrophysics and Space Science	108	19	24	0.46	1.43
International Journal of Theoretical Physics	97	13	22	0.32	1.347
Pramana - Journal of Physics	74	10	17	0.38	1.688
Modern Physics Letters A	73	11	15	0.47	1.367
Journal of Applied Physics	72	20	31	0.97	2.138
International Journal of Modern Physics D	69	15	24	0.75	2.004
Indian Journal of Physics	68	8	12	0.28	1.407
Applied Surface Science	67	22	33	1.23	5.27
Physica Scripta	66	10	16	0.53	1.985
General Relativity and Gravitation	65	18	27	0.71	2.03
Physics of Plasmas	65	15	26	0.73	1.913
Sensors and Actuators, B: Chemical	65	27	48	1.63	7.1
Langmuir	63	33	54	1.09	3.557
Microwave and Optical Technology Letters	60	9	13	0.33	0.957
Colloids and Surfaces A: Physicochemical and Engineering Aspects	57	20	28	0.78	3.99
Journal of Surface Science and Technology	56	8	13	0.16	na
Chemical Physics Letters	55	14	24	0.53	2.029
Crystengcomm	55	22	33	0.81	3.117
European Physical Journal C	55	19	29	1.76	4.389
Spectrochimica Acta - Part A: Molecular and Biomolecular Spectroscopy	54	12	21	0.6	3.232

3.3 Source Titles Profile

From the above analysis, it is interesting to note that the top 20 most sought journals cumulatively share about 23% of the total publications.

The impact of research productivity of JU in physics can be explained on the basis of the following indicators: (i) H-index: Although generally the H-index is used to measure the scientific performance of a single researcher through his/her publications, it has also been applied to measure performance of a broader range of subjects, such as, journals, organizations or countries [62]. Thus, we have taken into consideration of H-index in this respect. During the period under study, the value of H-index of top most sought journals is varying between 8 and 33. (ii) Impact Factor: It is most popular indicator in order to judge the relative importance of a journal within its discipline. Here, we can observe that the average Impact Factor (IF) for the top 20 publications is 2.547, with values ranging from 0.957 to 7.1. Seven of the top twenty publications have an impact factor of 1 to 2, four have an impact factor of 2 to 3, and seven have an impact factor of greater than 3. In most fields, the impact factor of 10 or greater is considered an excellent score while 3 is flagged as good and the average score is less than 1 (SCI). It is also a fact that the IF value e”2 for a journal in physics is often considered as an excellent one. So, we can see that most of the journals of our study are included under good category of journals of SCI. (iii) there is another indicator, SCImago

Journal Rank Indicator (SJR) which allows for the estimation of a journal's impact without the influence of self-citations, since prestige can be transferred to a journal by all other journals but not by itself (). Here, we find that the value of SJR varies between 0.16 and 1.76 in case of top 20 journals. The analysis also indicates that journals are distributed in different quartile (Q) as per its classified sub-disciplines. Six journals belong to first quartile (Q1) i.e. belong to top 25% journals in the list, nine journals occupied by Q2 category (25% to 50% group), Q3 (50% to 75% group) is occupied by four journals, and only one journal is under Q4 (75% to 100%) category.

DYNAMIC TREND OF MOST FREQUENT KEYWORDS

By and large, it is assumed that the keywords of the author are the materialization of research themes and thereby provides a direction of trends of research within a given field.

TABLE-4

34 Most Frequent Keywords

S. NO	Words	Occurrences
1	field emission	50
2	general relativity	47
3	Photoluminescence	40
4	Cosmology	37
5	Optimization	37
6	Fluorescence	36
7	dark energy	35
8	optical properties	33
9	heat transfer	29
10	crystal structure	28
11	Stability	28
12	Microstructure	25
13	Xrd	25
14	Adsorption	24
15	dark matter	24
16	Thermodynamics	24
17	x-ray diffraction	23
18	higher dimension	21
19	impedance spectroscopy	21
20	Nanocomposite	21

As seen from the above table (Table-4), the most sought after author's keyword is 'field emission' with 50 time occurrences, followed by 'general relativity' with 47 occurrences, 'photoluminescence' with 40 occurrences, and so on. The following figure is the showcase of the growth of word occurrences during the period under study. The following figure depicts the year- wise distribution of keywords.

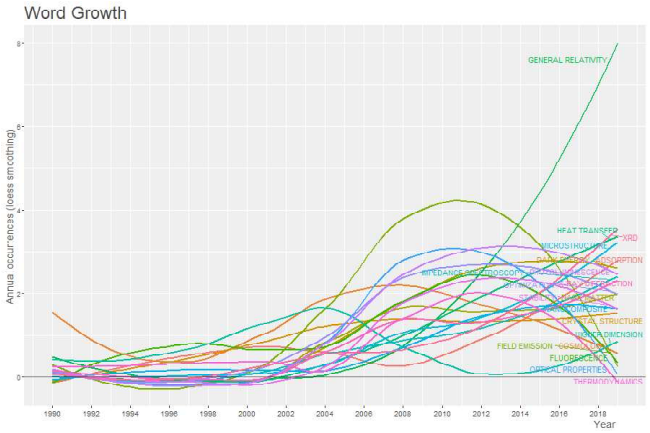

Fig. 5 Top Twenty Dynamic Keywords

It has also been observed that 'Field Emission' was the most preferred keyword till the year 2011. It can be seen that the keyword 'General Relativity' has become the most preferred keyword from the year 2014 onwards (Fig. 5).

CO-OCCURRENCE OF AUTHOR KEYWORDS

The co-occurrence network of keywords is generated using VOSviewer. In the scientific mapping of author keywords on the basis of clustering approach, it can be observed that the numbers of emerged clusters are six. At least, the number of occurrences of a keyword is 15 in a set of 10336 author keywords, and 42 keywords meet the threshold. Among these 42 keywords, 4 are not connected to each other. Therefore, the co-occurrence of author keywords has been formed on the basis of the largest set of connected terms (38), as shown in the Figure-6.

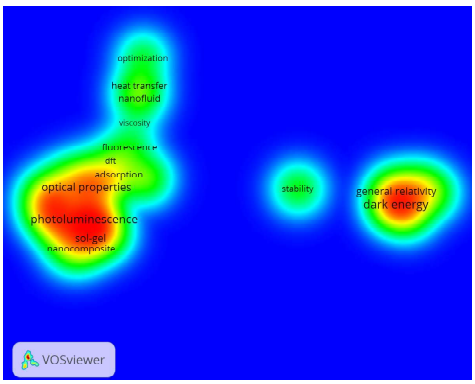

Fig.6 Co-occurrence of author keywords

The total number of links in this case is 103.

CITATION ANALYSIS

An analysis of Citations gauges the influence of a journal as well as the impact of an author's writing. It calculates an author's total number of publications, total citations from these publications, and the reputation of the journals in which those papers were written.

MOST CITED COUNTRY

We calculated all of the countries that appeared in the country of association area in the citing articles. In all, 36 countries were cited in the reports, with a total of 54927 frequencies. India was the most frequently mentioned country in the papers, with 50293 frequencies, followed by the USA with 1035 frequencies, Spain with 807 frequencies, Germany with 530 frequencies, UK with 483 frequencies and so on.

TABLE-5
35 Most Cited Countries

S. No	Country	Total Citations	Average Article Citations
1	India	50293	14.17
2	USA	1035	28.75
3	Spain	807	53.80
4	Germany	530	16.56
5	United Kingdom	483	32.20
6	Korea	238	10.35
7	Pakistan	159	39.75
8	Hong Kong	124	10.33
9	Canada	123	30.75
10	Italy	119	17.00
11	Poland	113	28.25
12	Portugal	100	16.67
13	Macedonia	88	44.00
14	China	83	16.60
15	Finland	79	79.00
16	Brazil	78	39.00
17	Japan	77	12.83
18	Iran	66	16.50
19	Belgium	53	26.50
20	South Africa	45	6.43

Table-5 gives the countries with high frequencies (at least 45 citations) appeared in the citing papers. The share of foreign countries output in the overall of JU output is 8.43 % during the period under study.

MOST CITED PUBLICATIONS (GLOBALLY)

There are ten widely cited articles in physics authored by the researchers of JU that have gained over 190 citations. Table-6 contains the bibliographic information for all 10 frequently cited articles.

TABLE-6

36 Most Cited Articles

SI No.	Researchers	Paper	Source	Total Citations	TC per Year
1.	Majumder, M. et al.	Fibre Bragg gratings in structural health monitoring-Present status and applications.	Sensors and Actuators, A: Physical, 2008, 147 (1): 150-164.	650	50
2.	Moulik, S.P. and Paul, B.K.	Structure, dynamics and transport properties of micro emulsions.	Advances in Colloid and Interface Science, 1998, 78 (2): 99-195.	539	23.43
3.	Basu, S. and Bhattacharyya, P.	Recent developments on graphene and graphene oxide based solid state gas sensors.	Sensors and Actuators, B: Chemical, 2012, 173: 1-21.	430	47.77
4.	Banerjee, A.N. and Chattopadhyay, K.K.	Recent developments in the emerging field of crystalline p-type transparent conducting oxide thin films.	Progress in Crystal Growth and Characterization of Materials, 2005, 50, (1-3): 52-105.	275	17.18
5.	Debnath, U., Banerjee, A. and Chakraborty, S.	Role of modified Chaplygin gas in accelerated universe.	Classical and Quantum Gravity, 2004, 21 (23): 5609-5617.	262	15.41
6.	Santra, A.K., Sen, S. and Chakraborty, N.	Study of heat transfer due to laminar flow of copper-water nanofluid through two isothermally heated parallel plates.	International Journal of Thermal Sciences, 2009, 48 (2): 391-400.	244	20.33
7.	Seth, S.K. et al.	Supramolecular self-assembly of M-IDA complexes involving lone-pair ···φ Interactions.	Crystal Growth and Design, 2011, 11 (7): 3250-3265.	208	20.8
8.	Sarkar, A. et al.	Static local field factor for dielectric screening function of electron gas at metallic and lower densities.	International Journal of Thermal Sciences, 2008, 47(9): 1113-1122.	204	8.86
9.	Santra, A.K., Sen, S. and Chakraborty, N.	Study of heat transfer augmentation in a differentially heated square cavity using copper-water nano-fluid.	International Journal of Thermal Sciences, 2008, 47(9): 1113-1122.	194	14.92
10.	Mitra, I., Saha, A. and Roy, K.	Exploring quantitative structure-activity relationship studies of antioxidant phenolic compounds obtained from traditional Chinese medicinal plants.	Molecular Simulation, 2010, 36 (13): 1067-1079.	193	17.54

During the period 2009–2019, the first paper got 650 citations. Annually, there was an average of 50 citations. In 2017, the largest numbers of citations (84) were received. The paper two has received 539 citations during 1999–2019. Annually, there was an average of 23.43 citations. The highest citations 37 were received in 2008. The third paper has received 430 citations between 2013 and 2019. The average citations per year were 47.77 and it has achieved the largest numbers of citations in 2017. It can be seen from the analysis that all these articles began receiving citations after one year of publishing and continued to do so during the research period.

CO-CITATION LINKS

Diodato[63] believes that co-citation transpires when two or more authors, documents or Journals are cited by another document simultaneously. Based

on co-citation analysis, author co-citation analysis was developed by White[64] and White & Griffith[65].

We know that the distance between two authors/journals in a network visualization roughly indicates their relatedness in terms of co-citation connections. The greater the relationship between two objects, the closer they are located to each other.

CO-CITATION NETWORKS (SOURCE TITLES)

The "minimum number of documents of a source" has been set to 100 to make the network more transparent. As a result, only journals with more than one hundred articles on physics would be shown. Just 204 journals out of 33139 reach the criterion of 10626 ties.

The 204 journals are divided into five groups, each with their own theme and color scheme (Figure-7). As can be shown that Physical Review D has got the most citations (5172) and also has the highest overall correlation strength (132242), followed by Physical Review Letters (3585 citations) along with 100255 total link strength, Physics Letters B (2417 citations) along with 70226 links strength and so on.

4 CONCLUSIONS

From the analysis conducted, it is amply clear that contribution of Jadavpur University in physics acquired an increased momentum after 2015 and maintains a linear pattern till the period under study. The share of physics output in the overall of JU was 24.11% during the period under study. The Average Annual Growth Rates (AAGR) are 6.51% and 12.12% for physics output during the decade 2000-2009 and for 2010-2019 respectively. The average citation per paper registered by physics publications of JU was 11.61.

The average citation per year per paper registered by physics publications of JU was 1.273. The most-frequently used document type was article (5013; 84.26%). About 19.43% involved international collaboration during 1990-2019. It has found that about 12.71% papers were shared by the top ten most contributed foreign countries. The average number of authors per document is 0.643 and the average number of documents per author is 1.56. The top 20 most sought-after journals cumulatively share about 23% of the total publications. The most sought out author keyword is 'field emission' with 50 time occurrences, followed by 'general relativity' with 47 occurrences. All the top cited articles began receiving citations after one year of publishing and continued to do so during the research period.

It can be concluded that the publication pattern of JU obviously follows the publication pattern of the other top Indian universities, both in terms of publication productivity and citation effect. The positions of Jadavpur University

in the recent ranking system of higher education institutions conducted by several renowned agencies also reflect a progressive metamorphosis of this institution. The study expects that institutions will continue to use scientometric evaluations to develop plans and evidence-based management practices. The research findings will assist various policy-making authorities and financing organizations in providing increased financial assistance to Jadavpur University.

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