



AN ANALYTICAL STUDY ON EXPONENTIAL GROWTH RATE AND AUTHOR PRODUCTIVITY IN NEUTRINO RESEARCH

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ABSTRACT :

The present study analyzes the Exponential growth rate and trends in author productivity trend of Neutrino Research from 2011 to 2017. The results found that exponential growth rate was increased 1.01 in 2015 to 1.13 in 2016. Two authored contributions was higher (2502 records) followed by triple, multiple and single authors. The Average Author per Paper is increased from 10.7 to 11.01 from the year 2015 to 2017.



KEYWORDS : Neutrino, Author Productivity, Exponential Growth Rate, Degree of collaboration, Authorship pattern.

INTRODUCTION

Nalimov has coined the word 'Scientometrics' in 1971. It will help to develop the quantitative methods of the research in the development of science as an information process. In Science discipline, Physics is one of the most oldest and stronger subject. The main goal of the Physics is to understand how the universe behaves. The physics subject has slowly entered other areas like astronomy, natural physics, thermodynamics, etc. The physics has been adopted other subjects such as Mathematics, Chemistry, Technology, etc. as interdisciplinary in nature. Neutrinos were first postulated by Pauli in 1930 to explain the continuous electron energy distribution in nuclear beta decay. Later, in 1934, they were christened as such by Fermi who made them the basis of his theory of weak interactions. Indumathi et al. (2004) have stated that these particles would be difficult to observe because their cross sections are so small. More number of research on Neutrino have been carried out both International and Indian levels.

The present study has analyzed the Exponential growth and productivity of authors in Neutrino research from 2011 to 2017. Further, the authorship pattern, degree of collaboration and prominent keys used for data retrieval is also discussed.

REVIEW OF LITERATURE:

Vijay (2005) has studied the collaborative research and authorship trend in food science and technology in India from 1994 to 2003. The study revealed that trend on Average Author per Paper was upward during the study period. Thanuskodi and Venkatalakshmi (2010) have studied the Growth and Development of Research on Ecology in India. Sanjeevi and Mahendran (2011) have studied the productivity of Research output on Lagoons. Amsaveni and Vasanthi (2013) have showed the trend in authorship pattern and collaborative research in network security with a sample of 8051 articles

downloaded from the database of web of knowledge during 2002 to 2011 (one decade) with 5343 LCS and 44721 TGCS measured. Suresh Kumar (2016) has done evaluative study on author productivity applied Lotka's Law in artificial neural network in India from 1991 to 2014. The productivity of authors on the publications in the Journal of documentation from 2003 to 2015 was studied by Suresh Kumar (2017). The study revealed that majority of the publications was published with single author.

METHODOLOGY

The data for present study was collected from the Web of Science database. The collected data were analyzed through the Histcite software. The tools like simple percentage and other formula for authorship pattern and author productivity was also used. The journal articles, books, website and other sources were used as secondary sources. The study considered the productivity of information only in the area of Neutrino Research.

OBJECTIVES

The major objective of the present study is:

- ✓ To study the exponential growth rate of Neutrino research
- ✓ To analyse the authorship pattern
- ✓ To find out the degree of collaboration
- ✓ To analyze the authorship productivity
- ✓ To study the prominent key words used data retrieval

Results

The year-wise publication and Exponential growth of the Neutrino Research contributions during the study period is given in Table – 1.

Table 1 Exponential Growth Rate of Neutrino Research

S. No	Year	Publications	Exponential Growth Rate
1	2011	1362	---
2	2012	1545	1.13
3	2013	1526	0.99
4	2014	1486	0.97
5	2015	1505	1.01
6	2016	1699	1.13
7	2017	1625	0.96
Total		10748	6.19

From the above analysis, the highest publication (1699 records) was found in 2016 and lowest (1362 records) was in 2011. The publication range during the study period was increasing and decreasing trend. The value of exponential growth rate of the published article was increased only between 2015 (1.01) and 2016 (1.13). Rest of the years the difference of growth rate is very meager.

The authorship patter of the published articles were categorized as Single, Two, Three, Four, Five and >5 authors and calculated values are presented in Table-2.

Table 2 Authorship Pattern in Neutrino Research

Year	2011	2012	2013	2014	2015	2016	2017	Total	Percentage
Single Author	268	312	303	267	235	280	246	1911	17.78%
Two Authors	339	379	348	343	352	384	357	2502	23.28%
Three Authors	298	305	342	362	345	346	285	2283	21.24%
Four Authors	169	168	181	168	180	233	274	1373	12.77%
Five Authors	61	83	76	81	95	116	175	687	6.39%
>5 Authors	227	298	276	265	298	340	288	1992	18.53%
Total	1362	1545	1526	1486	1505	1699	1625	10748	100

Totally 10748 authors were contributed during the study period. Out of six category of authors, two authored publication was more (2502 articles) when compared to three and more than five authors 21.24%, 18.53% respectively. In the year-wise authorship pattern also shown that two author contributions was higher and five author contributions occupied last position (6.39%).

To find out the degree of collaboration, the formula given by K. Subramanyam was used. The formula is

$$C = \frac{NM}{NM + NS}$$

Where,

C = Degree of collaboration in discipline

Nm = Number of multiple authored papers

Ns = Number of single authored Papers

Table 3 Degree of Collaboration in Neutrino Research

year	Single Author	Multi Author	Degree of Collaboration
2011	268	1094	0.80
2012	312	1233	0.80
2013	303	1223	0.80
2014	267	1219	0.82
2015	235	1270	0.84
2016	280	1419	0.84
2017	246	1379	0.85
Total	1911	8837	0.82

The analyzed results for degree of collaboration shows that the multi author contribution was higher compared to single author contribution during the study period. The degree of collaboration in Neutrino research was increased from 0.82 to 0.85 between 2014 and 2017.

Table 4 Author Productivity

S. No	Year	Total No. of Publications	Total No. of Authors	AAPP*	Productivity per year**
1	2011	1362	16720	12.27	0.08
2	2012	1545	16187	10.47	0.09
3	2013	1526	15784	10.34	0.09
4	2014	1486	14546	9.78	0.1
5	2015	1505	16103	10.7	0.09
6	2016	1699	18477	10.87	0.09
7	2017	1625	17894	11.01	0.09
Total		10748	115711	10.7	0.09

*Average Authors per Paper (AAPP) = Number of authors / Number of articles.

**Productivity per author = Number of articles / Number of authors

The formula for Average Authors per Paper [AAPP] was adopted to analyze productivity of authors. The computed values between total number of publications and total number of authors are gradually increased except 2013 and 2014 and it was clearly noticed the growth rate of AAPP was increased from 2015 (10.7) to 2016 (11.01). The productivity of authors during the study period was also slight variations at the level of fractions and not in increasing or decreasing trend. .

Table 5 Top-10 Key Words

S. No.	Word	Records	TLCS	TGCS
1	Neutrino	<u>3019</u>	4244	41771
2	Neutrinos	<u>1018</u>	1587	14593
3	Matter	<u>1008</u>	1313	14698
4	Dark	<u>984</u>	1256	15170
5	Model	<u>820</u>	1293	10185
6	Mass	<u>677</u>	1326	9770
7	Energy	<u>534</u>	513	7121
8	Decay	<u>501</u>	888	8048
9	Flavor	<u>414</u>	527	5789
10	Lepton	<u>413</u>	762	5069

The keyword Neutrino was occupied first position (3019 records) with the Total Local Citation Score of 4244 and Total Global Citation Score of 41771. The other keywords viz., Neutrinos, Matter, Dark, Model were appeared in next positions. The keyword Lepton was appeared in 10th position with 413 records.

CONCLUSION

The present study revealed that the Exponential growth rate of the published articles during the study period was increased only in last two years. In the authorship pattern two author contributions was more and occupied first position. The single author Vs. multiple author trend was gradually increased throughout the study period compared to degree of collaboration. The study found that the trend on author productivity per year was also stable even the total number of publications and total number of authors contribution have been increased during the study period.

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