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Growth of literature in Higgs Boson: A Scientometric analysis of SCOPUS database (2005-2014)

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Abstract:

The paper analyses the growth pattern of Higgs Boson literature during 2005-2014 (10 years). The scopus database has been used to retrieve relevant data. Total number of publication has been identified as 4359 records contributed worldwide over a period of 2005-2014. The distribution of publications based on the year of production, country wise productivity, document type of the publications, Major subject categories, authors whose contribution is in the maximum level were studied. The organizations contribute Higgs Boson research have also been studied.

Keywords: Bibliometric; Higgs Boson; Literature growth; Scientometric

Introduction:

Scientometrics is one of the most important measures for the assessment of scientific production. Scientometrics is the science of measuring and analyzing science. In practice, scientometrics is often done using bibliometrics that is measurement of (scientific) publications. One of the most reliable ways to track science and technology activities is the study of scientific literature (Journal Articles, News, Review, Comment, Letter, Editorial, Newspaper Article, etc.), co-authorship, patents, citations, cocitations. Scientometrics is related to and has overlapping interests with bibliometrics and informetrics. There are many definitions for the term "Scientometrics" in the literature; Scientometrics is the quantitative study of the disciplines of science based on published literature and communication. This could include identifying emerging areas of scientific research, examining the development of research over time, or geographic and organizational distributions of research. The Higgs boson (or Higgs particle) is a particle that gives mass to other particles. Peter Higgs was the first person to think of it, and the pa. It is part of the Standard Model in physics, which means it is found everywhere. It is one of the 17 particles in the Standard Model. The Higgs particle is a boson. Bosons are particles responsible for all physical forces except gravity. Other bosons are the photon, the W and Z bosons, and the gluon.

Objectives

The objectives of the study are

- To examine the overall year wise production of articles worldwide in Higgs Boson research during the period 2005-2014;
- To examine country wise growth of literature in Higgs Boson during the period 2005-2014;
- To analyze the document type of the publication;
- To identify source titles of the literature;
- To Identify top 20 authors whose contribution is in the maximum level;
- To Identify top 20 Institute name which has a maximum output

Methodology:

The data has been collected for the study growth of literature in Higgs Boson from Scopus database (www.scopus.com). Scopus is the World largest database for published abstract and peer review journals. The term “Higgs Boson” used for collect relevant data in Scopus database. Only ten years (2005-2014) published document has been incorporated for this study. After searching found 4359 documents from Scopus and tabulated all the data in Microsoft excel format, and sorting them according to requirements.

Data analysis and results:

Table 1: Year wise productivity

Sl no	Year	No of documents	%
1	2014	606	13.90
2	2013	800	18.35
3	2012	695	15.94
4	2011	379	8.69
5	2010	382	8.76
6	2009	357	8.19
7	2008	374	8.58
8	2007	298	6.84
9	2006	243	5.57
10	2005	225	5.16
	Total	4359	100

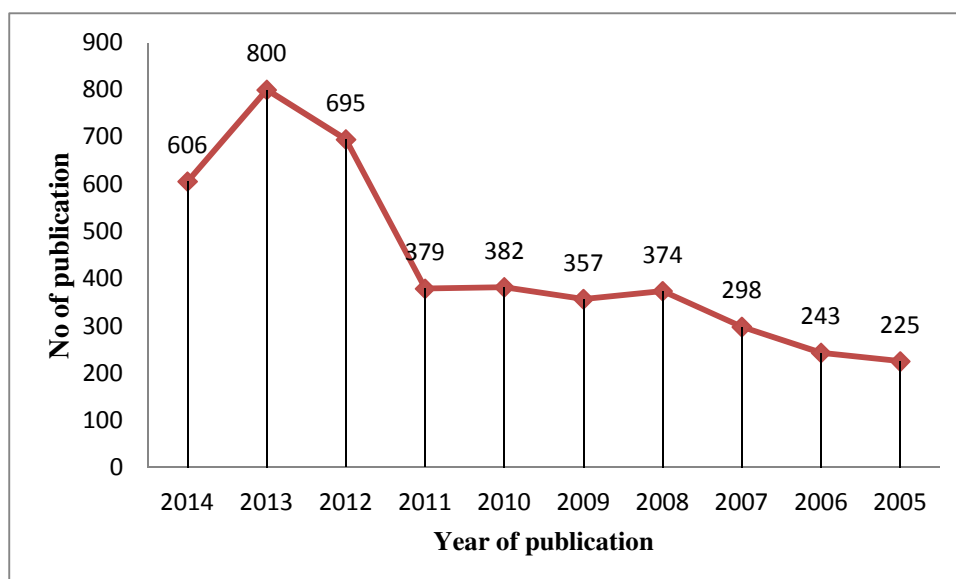


Figure 1: Year wise publication

It is seen from table no 1 that a total no 4359 documents has been published in SCOPUS database during the year 2005-2014 in the subject Higgs Boson. Total 4359 research documents published with an average 435.90 articles per year. Out of 4359 articles highest no research articles were published in the year 2013

(800, 18.35%) and 695 (15.95%) articles published in the year 2012. After seen year wise productivity it is concluded that growth of research articles publication increasing gradually from the year 2005 to 2014.

Table 2: DOCUMENT TYPES

Sl. No	Types of documents	No of article	%
1	Article	3062	70.25
2	Conference Paper	1045	23.97
3	Review	101	2.32
4	Conference Review	47	1.08
5	Erratum	26	0.60
6	Short Survey	20	0.46
7	Book Chapter	17	0.39
8	Article in Press	14	0.32
9	Note	9	0.21
10	Book	8	0.18
11	Letter	6	0.23
12	Editorial	4	0.25
	Total	4359	100

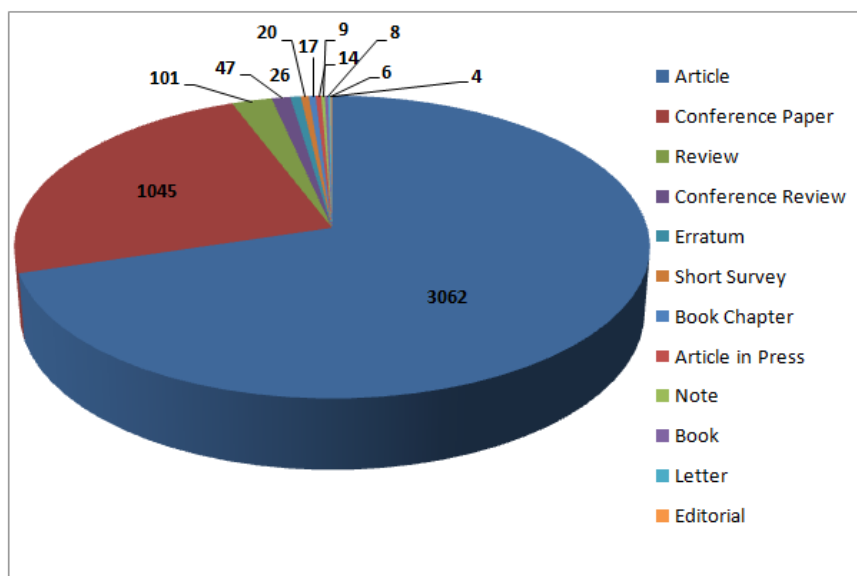


Figure 2: Type of document publication

There are various types of documents have been published on Higgs Boson in the SCOPUS database such as article, conference paper, review, conference review, survey, book chapter, note etc. Research productive documents have been categorized in 13 bibliographic formats. Most of the documents were published in research article form i.e. 70.75% and 23.97% of documents were published as conference paper forms.

Table 3: Documents by subject area

Sl. No	Name of subject	No of articles published	%
1.	Physics and Astronomy	4061	81.97
2.	Mathematics	324	6.54
3.	Multidisciplinary	208	4.20
4.	Engineering	170	3.43
5.	Computer Science	57	1.15
6.	Medicine	29	0.59
7.	Social Sciences	26	0.52
8.	Arts and Humanities	16	0.32
9.	Materials Science	13	0.26
10.	Earth and Planetary Sciences	12	0.24
11.	Psychology	10	0.20
12.	Business, Management and Accounting	5	0.10
13.	Chemistry	5	0.10
14.	Energy	5	0.10
15.	Decision Sciences	4	0.08
16.	Economics, Econometrics and Finance	3	0.06
17.	Biochemistry, Genetics and Molecular Biology	2	0.04
18.	Chemical Engineering	2	0.04
19.	Agricultural and Biological Sciences	1	0.02
20.	Environmental Science	1	0.02
	Total	4954	100

Table no 3 described that research document have been published in 20 research area or subject fields. Among this 20 research area more than 80% documents have been published under the subject category physics and astronomy. So, from the table no. 3 it is clearly notified that maximum no of research work in Higgs Boson has been going on the subject field Physics and Astronomies and lowest no of research work have been done 15 subject out of 20 research field which published document is less than 1%.

Table 4: Top 20 source titles of articles

Sl No	Name of source title	No of Articles	%
1	Physical Review D Particles Fields Gravitation and Cosmology	999	22.92
2	Journal of High Energy Physics	613	14.06
3	Physics Letters Section B Nuclear Elementary Particle and High Energy Physics	354	8.12

4	Aip Conference Proceedings	193	4.43
5	European Physical Journal C	189	4.34
6	Physical review letter	184	4.22
7	International journal of modern physics A	100	2.29
8	Journal of Physics Conference Series	98	2.25
9	Nuclear Physics B Proceedings Supplements	88	2.02
10	Nuovo Cimento Della Societa Italiana Di Fisica C	87	2.00
11	Nuclear Physics B	78	1.79
12	Acta Physica Polonica B	70	1.61
13	Modern Physics Letters A	51	1.17
14	Journal of Cosmology and Astroparticle Physics	40	0.92
15	Journal of Physics G Nuclear and Particle Physics	36	0.83
16	Pramana Journal of Physics	35	0.80
17	Computer Physics Communications	22	0.50
18	Communications in Theoretical Physics	18	0.41
19	Physics of Atomic Nuclei	18	0.41
20	IEEE Nuclear Science Symposium Conference Record	15	0.34

Table no 4 described name of 20 source title or Journals which are published maximum no of articles in the subject Higgs Boson. Among the top 20 source title the highest productive journals are Physical Review D Particles Fields Gravitation and Cosmology which published 999 research articles and covered 22.92% followed by 613(14.06%) were in journal of High Energy Physics, 354 (8.12%) were in Physics Letters Section B Nuclear Elementary Particle and High Energy Physics. Out of 20 source title more than 100 research documents were published from 7 journals and remaining 13 journals published less than 100 research documents.

Table 5: Analysis of top three Journal Metrics: SJR, IPP and SNIP

Sl no	Name of journal	Year	SJR	IPP	SNIP	Citation	Docs
1	Physical Review D - Particles, Fields, Gravitation and Cosmology	2005	2.452	3.855	1.245	81593	2318
2	Physical Review D Particles, Fields, Gravitation and Cosmology	2006	2.74	4.159	1.241	90512	2397
3	Physical Review D Particles, Fields, Gravitation and Cosmology	2007	3.038	3.975	1.324	92574	2335
4	Physical Review D Particles, Fields, Gravitation and Cosmology	2008	2.766	4.289	1.506	104172	2913
5	Physical Review D Particles, Fields, Gravitation and Cosmology	2009	2.712	4.509	1.549	113362	2866
6	Physical Review D Particles, Fields, Gravitation and Cosmology	2010	2.611	4.334	1.41	117517	3005
7	Physical Review D Particles, Fields, Gravitation and Cosmology	2011	2.626	4.193	1.43	122847	3069
8	Physical Review D Particles, Fields, Gravitation and Cosmology	2012	2.404	3.718	1.204	120768	3443
9	Physical Review D Particles, Fields, Gravitation and Cosmology	2013	1.899	3.192	1.136	106431	3307
10	Physical Review D Particles, Fields, Gravitation and Cosmology	2014	NA	NA	NA	98775	3165
11	Journal of High Energy Physics	2005	2.072	3.772	0.966	15318	859

12	Journal of High Energy Physics	2006	1.476	3.594	0.934	17676	1023
13	Journal of High Energy Physics	2007	1.288	3.68	0.978	19835	1244
14	Journal of High Energy Physics	2008	1.344	3.674	1.011	23469	1228
15	Journal of High Energy Physics	2009	1.301	4.075	1.163	27346	1214
16	Journal of High Energy Physics	2010	1.462	4.059	1.103	28568	1372
17	Journal of High Energy Physics	2011	1.572	4.5	1.268	34652	1622
18	Journal of High Energy Physics	2012	1.088	3.808	1.068	33695	1858
19	Journal of High Energy Physics	2013	1.027	3.157	0.832	35084	1923
20	Journal of High Energy Physics	2014	NA	NA	NA	35627	1863
21	Physics Letters, Section B: Nuclear, Elementary Particle and High-Energy Physics	2005	2.721	3.995	1.41	54261	977
22	Physics Letters, Section B: Nuclear, Elementary Particle and High-Energy Physics	2006	3.119	4.029	1.381	57270	1018
23	Physics Letters, Section B: Nuclear, Elementary Particle and High-Energy Physics	2007	3.215	3.568	1.345	54478	860
24	Physics Letters, Section B: Nuclear, Elementary Particle and High-Energy Physics	2008	2.768	3.478	1.346	55200	968
25	Physics Letters, Section B: Nuclear, Elementary Particle and High-Energy Physics	2009	2.875	3.953	1.692	59040	940
26	Physics Letters, Section B: Nuclear, Elementary Particle and High-Energy Physics	2010	3.059	3.992	1.547	59735	780
27	Physics Letters, Section B: Nuclear, Elementary Particle and High-Energy Physics	2011	3.121	3.773	1.666	59392	1025
28	Physics Letters, Section B: Nuclear, Elementary Particle and High-Energy Physics	2012	3.54	4.098	2.119	64919	879
29	Physics Letters, Section B: Nuclear, Elementary Particle and High-Energy Physics	2013	4.422	4.968	2.679	62858	796
30	Physics Letters, Section B: Nuclear, Elementary Particle and High-Energy Physics	2014	NA	NA	NA	54396	813

Table 5 shows the value of SJR, IPP and SNIP number of citation and number of documents for the top three journals. SJR (SCImago Journal Rank) is developed by Professor Felix de Moya, Research Professor at Consejo Superior de Investigaciones Cientificas and Vicente Guerrero Bote at University of Extremadura. SCImago Journal Rank (SJR) is a prestige metric based on the idea that 'all citations are not created equal'. It is a size-independent indicator and it ranks journals by their 'average prestige per article' and can be used for journal comparisons in science evaluation process. In the year 2014 the value of SJR, IPP and SNIP are not found.

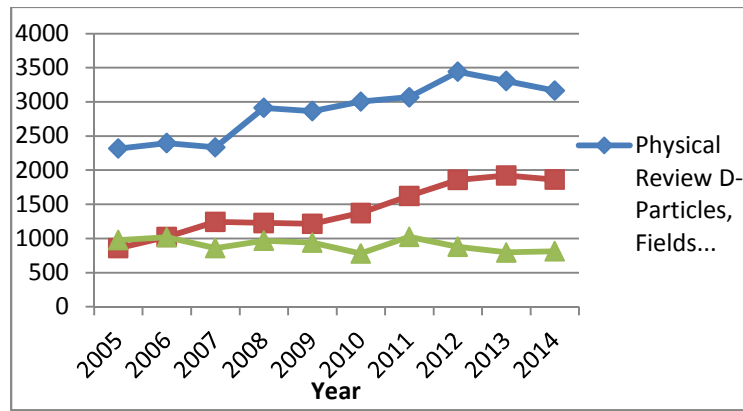


Figure 3: No of Documents VS Year for the top three Journals

Figure 3 shows the number of documents published every year for the top three journals. Journal of Physical Review D - Particles, Fields, Gravitation and Cosmology has been published more number of documents ranges from 3165 to 2318.

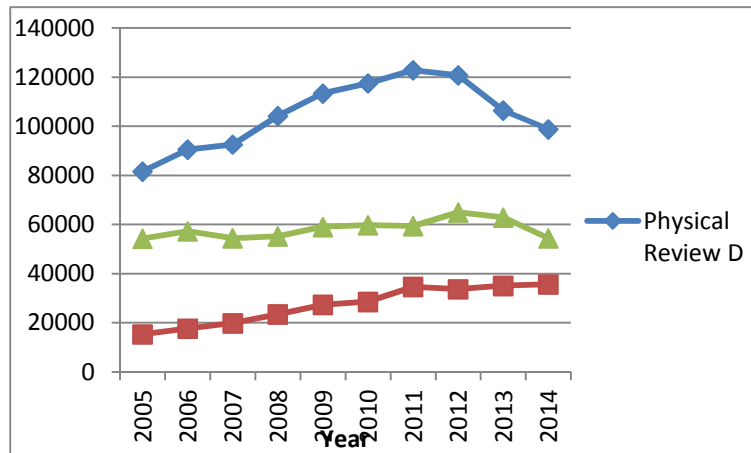


Figure 4: No of Citation VS Year for the top three Journals

Figure 4 shows the number of citations per year for the top three journals. It reveals that Physical Review D - Particles, Fields, Gravitation and Cosmology has citations varies between 81593 and 122847 during the year 2005-2014. So Physical Review D - Particles, Fields, Gravitation and Cosmology ranks first among the journals which published articles in the field of Higgs Boson.

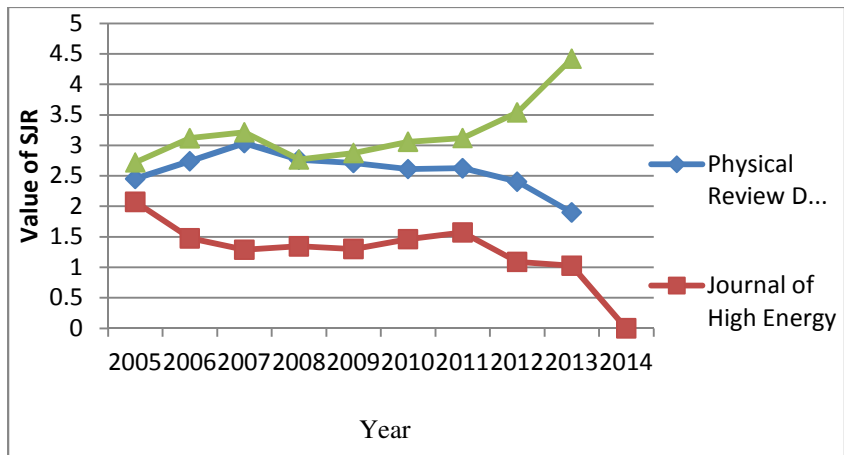


Figure 5: Value of SJR VS Year for the top three Journals

Figure no. 5 reveals that journal of Physics Letters, Section B: Nuclear, Elementary Particle and High-Energy Physics has high SJR value varies between 2.721 to 4.422 during the year 2005 to 2014. Relatively high SJR is worth more than a citation from a source with a relatively low SJR.

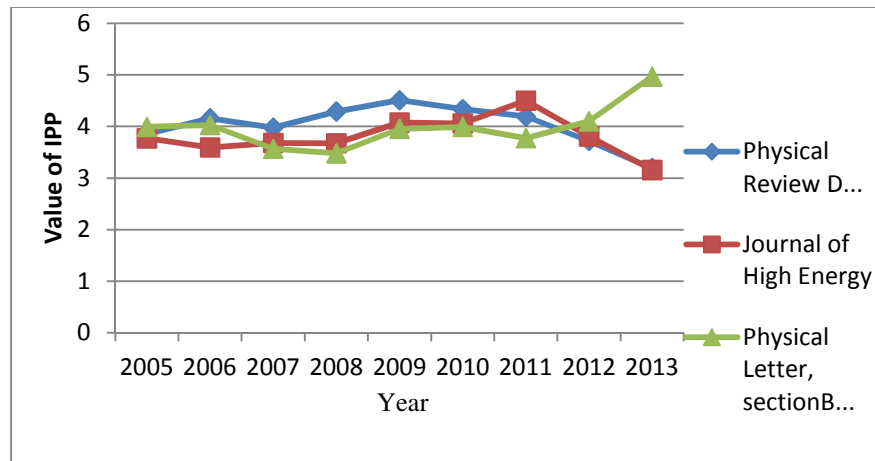


Figure 6: Value of IPP VS Year for the top three Journals

Impact per Publication metric was also developed by Leiden University's Centre for Science & Technology Studies (CWTS). The IPP measures the ratio of citations in a year (Y) to scholarly papers published in the three previous years (Y-1, Y-2, Y-3) divided by the number of scholarly papers published in those same years (Y-1, Y-2, Y-3). The IPP metric is using a citation window of three years which is considered to be the optimal time period to accurately measure citations in most subject fields. Figure no 6 shows that the value of IPP of three most productive journal in the field of Higgs Boson.

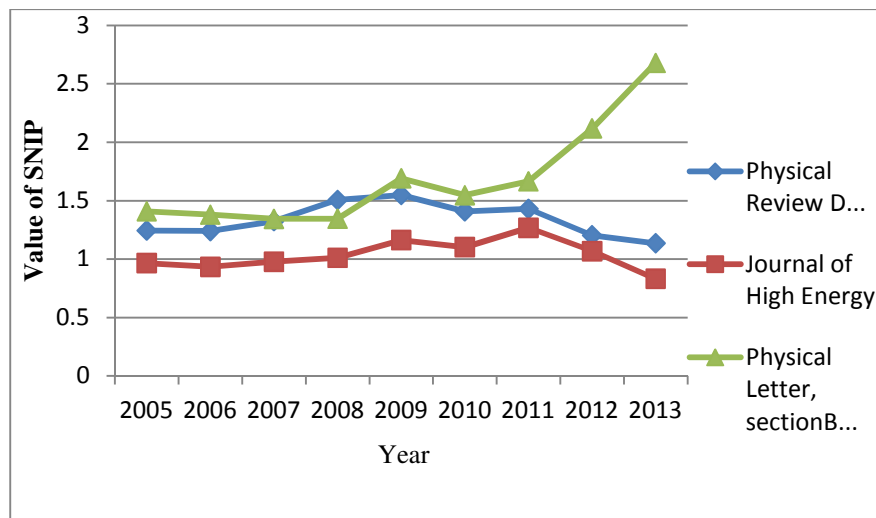


Figure 7: Value of SNIP VS Year for the top three Journals

SNIP Created by Professor Henk Moed at CTWS, University of Leiden, Source Normalized Impact per Paper (SNIP) measures contextual citation impact by weighting citations based on the total number of citations in a subject field. The impact of a single citation is given higher value in subject areas where citations are less likely, and vice versa. Figure 7 shows that the value of SNIP of three high productive journal.

Table 6: Top 20 countries

SI No	Name of country	No of productivity	%	Rank
1	United States	1370	11.75	1
2	Germany	823	7.06	2
3	United Kingdom	643	5.52	3
4	Switzerland	635	5.45	4
5	Italy	601	5.15	5
6	France	508	4.36	6
7	China	447	3.83	7
8	Japan	438	3.76	8
9	Spain	413	3.54	9
10	Russian Federation	367	3.15	10
11	Taiwan	298	2.56	11
12	India	296	2.54	12
13	South Korea	295	2.53	13
14	Canada	255	2.19	14
15	Poland	215	1.84	15
16	Mexico	208	1.78	16
17	Greece	197	1.69	17
18	Brazil	195	1.67	18
19	Czech Republic	170	1.46	19
20	Finland	159	1.36	20
	Total	8533 (out of 11659)	73.25	

Table no. 6 shows top 20 most prolific countries which are published major no of research articles in the fields of Higgs Boson during the year 2005-2014. This table also reveals that out of 11659 contribution, top 20 countries published 8533 (73.19% out of total contribution) no of articles. The United State is ranked 1st by published 1370 (11.75%) articles out of total contribution to the Higgs Boson literature during the period of study. Germany hold 2nd rank for publishing 823 (7.06%) no of articles followed by U.K. 643 (5.52%), Switzerland 635 (5.45%), Italy 601 (5.15%) and so on. India ranked 12 among top 20 countries. After study it is concluded that the field has evolve considerably in different region of the World.

Table 7: Top 20 Affiliated Institute

SI No	Name of Affiliation Institute	No of article	%	Rank
1	European Organization for Nuclear Research	425	9.75	1
2	Institute Nazionale Di Fisica Nucleare, Frascati	337	7.73	2
3	Fermi National Accelerator Laboratory	305	7.00	3
4	University of Wisconsin Madison	238	5.46	4
5	CEA Saclay	210	4.82	5
6	Alikhanov Institute for Theoretical and Experimental Physics	206	4.73	6
7	Joint Institute for Nuclear Research, Dubna	204	4.68	7
8	University Michigan Ann Arbor	196	4.50	8
9	Universita degli Studi di Roma La Sapienza	195	4.47	9
10	Argonne National Laboratory	189	4.34	10
11	University of Manchester	185	4.24	11
12	Deutsche Elektronen-Synchrotron	179	4.11	12
13	Michigan State University	178	4.08	13
14	Universite Paris-Sud XI	175	4.01	14
15	Laboratori Nazionali di Frascati di INFN	168	3.85	15
16	Northwestern University	166	3.81	16
17	Lomonosov Moscow State University	165	3.79	17
18	University of Chicago	164	3.76	18
19	Universita di Pisa	161	3.69	19
20	Massachusetts Institute of Technology	158	3.62	20
21	Others	155	3.56	
	Total	4359	100.00	

Table no. 7 shows that top 20 journals in the field of Higgs Boson which are arrange in descending order. This table also reveals the ranking of the journal based on research output of the literature Higgs Boson during the year 2005 2014. European Organization for Nuclear Research holds 1st rank by published 425 (9.75%) no of research document followed by Institute Nazionale Di Fisica Nucleare, Frascati and Fermi National Accelerator Laboratory hold 2nd rank and 3rd rank respectively.

Table 8: Top 20 Authors from Literature output

Sl No	Author	No of Documents	%
1	Bocci, A.	136	0.92
2	Banerjee, S.	111	0.75
3	Giunta, M.	104	0.71
4	Whiteson, D.	99	0.67
5	Cuevas, J.	99	0.67
6	Quadt	97	0.66
7	Paus	97	0.66
8	Giagu	97	0.66
9	Neal	97	0.66
10	Fiedler	97	0.66
11	Goulianos	97	0.66
12	Hebbeker	96	0.65
13	Grivaz	96	0.65
14	Huston	96	0.65
15	Rescigno	96	0.65
16	Muller	95	0.64
17	Davies	95	0.64
18	Eusebi	95	0.64
19	Herndon	95	0.64
20	Castro A.	95	0.64
21	Others	12739	86.49
	Total	14729	100

The top 20 prolific Authors are calculated based on their frequency of publication that has been listed above table no. 8. It is found that Bocci, A. is the leading author contributing 136 (0.92) articles followed by Banerjee, S. 111 (0.75) articles securing the second position. Giunta, M and Whiteson, D contributed 104 and 99 articles and ranked 3rd and 4th.

Conclusion:

Considering the above facts it is concluded that the research output in the field of Higgs Boson was higher i.e. 800 in the year 2013. In this study USA obtains 1st rank in world research output, only 2.54% of the articles were contributed by authors in India ranking 12th among top 20 countries. A Bocci has contributed maximum number of publication i.e 136. Three Journal metrics SJR, IPP and SNIP were analyzed. It shows that Physical Review D Particles Fields Gravitation and Cosmology was the prestigious and popular journal in the field of Higgs Boson. In India the research in this field is infantile stage. This may be due to non availability of funds and supportive training programs. Strengthening of training programs at institutional level, national and international level becomes mandatory. The lacking on the contribution may be due to non availability of international collaboration.

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