Indian Journal of Physics: A scientometric analysis

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Abstract

Peer reviewed journals in the field of Science, Technology and Medical (STM) are the main vehicles through which scientists publish their research output, communicate opinions and exchange observations. Governments and industries of many countries are investing more money than before in science research. As a result, research output in terms of publications of original research articles has been increased substantially in the recent past. So there is a steady growth in STM journal publishing industries too. But unfortunately journals published by universities and learned societies of third world countries are facing a stiff competition from large commercial publishing houses and those are on the verge of extinction due to merger and acquisitions by large commercial publishers. India is one of the fastest growing nations in terms of research output in science. Over the last few years India is trying to establish herself as a global leader in science. The number of original research articles published by Indian scientists has been increased substantially in the recent past. But very few journals in science and specifically in the subject physics with high impact factor are published from India. As a result Indian scientists have no choice but to use journals with high impact factor published from outside India to publish their research output. Amongst the core physics journals published from India, Indian Journal of Physics (IJP) is one bright exception. It not only survived the stiff challenges from commercial publishers but also excelled in many ways that is clearly visible with steady increase in its impact factor over the last few years and for the year 2012 the impact factor of IJP is 1.785 that is highest for any physics journal published from India and comparable with other well known physics journals published from USA and European countries. Bibliometric and scientometric studies were carried out for individual journals in the past for different purposes. IJP is now in the centre of attention to physicists all over the world because of its reasonably good impact factor and the journal is getting more number of original articles from all over the world. The objective of this study is to throw light on the factors those play the vital role for the improvement of its quality by analysing different bibliometric and scientometric data for IJP. The result of this study may be useful and the measures taken by IJP can be extrapolated to other similar journals published by universities and societies from third world countries for improvement.

Introduction

Periodicals are primary source of information and an important media for communication. They play a major role for communicating the latest research findings through publishing articles containing the current development in any field of knowledge. Information is one of the most important resources for a nation that forms the integral base for its economy. Information is growing out in an exponential rate which is often referred to as information explosion. Periodicals publication is also increasing day by day since the first scientific journal started publication in 1665. Periodicals are the indicators of literature growth in any field of knowledge. The advent of Internet technology has led to changes in the way journals operate, including faster review times, electronic submissions and tracking, and online publications. Online access of scientific literature has brought remarkable changes in the way knowledge is shared and disseminates due to its easy availability.

In this study we have considered Indian Journal of Physics to analyse different scientometric data for a period of ten years (2004-2013) because in recent past the journal has showed a remarkable growth both quantitatively and qualitatively. Indian Journal of Physics started its journey in the year 1926 and it is the oldest physics journal published from India. The journal is the brainchild of Sir C V Raman, the Nobel laureate physicist from India and he was the founder and first Editor. Prof. Raman felt the necessity of a physics journal of his own country India in those early days because it was not easy to communicate and publish original research work by Indians and that was also very time consuming. Prof. J C Bose, Prof. S N Bose and

other scientists at that time did not get their due credit for their original research. Many of the original research works of Prof. Raman were published in IJP and the second volume of the Journal published his famous article "A New Radiation", reporting the discovery of Raman Effect. Not only Prof. Raman but other doyens of Indian science like K S Krishnan, K Banerjee, S R Palit were contributed in IJP. IJP is a monthly journal in the field of physical sciences that covers almost all branches of physics namely Astrophysics, Atmospheric and Space physics, Atomic & Molecular Physics, Biophysics, Condensed Matter & Materials Physics, General & Interdisciplinary Physics, Nonlinear dynamics & Complex Systems, Nuclear Physics, Optics and Spectroscopy, Particle Physics, Plasma Physics, Relativity & Cosmology, Statistical Physics. Apart from its good user base, the journal is exchanged with many other journals published by learned societies of other countries. The journal is devoted to the publication of original scientific research results in the form of full papers, short notes and Rapid Communications. It also publishes Review Articles from time to time. The Journal emphasizes both fundamental and applied research work in Physics. The journal also publishes Reviews on books under Book-Reviews section. Proceedings of National and International Symposia held in India and Annual Endowment Lectures of IACS are also published from time to time. In addition, Special issues dedicated to distinguished physicists are also brought out. This journal is abstracted / indexed in SCOPUS, INSPEC, Chemical Abstracts Service (CAS), Google Scholar, Academic OneFile, Indian Science Abstracts, INIS Atomindex, INSPIRE, International Bibliography of Book Reviews (IBR), International Bibliography of Periodical Literature (IBZ), OCLC, SCImago, Summon by Serial Solutions.

Indian Association for the Cultivation of Science (IACS), the host institute and publisher of IJP is the oldest research institute (established in 1876) in India. It is devoted to the pursuit of fundamental research on physical sciences. Prof. Raman worked at IACS during 1907 to 1933 making discovery on scattering of light in1928, which bears his name and that brought the Nobel Prize in 1930. The American Chemical Society designated the Raman Effect as an International Historic Chemical Landmark in 1998 and honoured IACS. Apart from Raman almost all leading scientists at that time worked at IACS. Still it is one of the best performing research institutes in terms of research output, international collaboration and accolades. Till 2008 IJP was published, printed and distributed by IACS. In 2009 IACS took a historic decision to sign a co-publishing agreement with Springer, a leading name in journal publishing industry to delegate the right and license to electronically publish and distribute the SpringerLink Edition, and to distribute the International Print Edition outside of India. From 2013 onwards Springer is printing and distributing both national and international version of IJP.

The co-publishing agreement between IACS and Springer is the major turning point and can be considered as a perfect marriage between a reputed institute and a leading industry. In this paper we have found that it is a remarkable turnaround for IJP since 2009 because after that the journal is doing extremely well in all aspects of a STM journal. IACS and IJP have their reputation in scientific community all over the world and Springer has the strength of its marketing strategy, global presence taking advantage of using latest software and technology. IACS still holds the exclusive copyright of IJP and all editorial decisions and processes are being handled by the editorial board and the editorial office of IJP. International Advisory Board, Board of Editors, Honorary Associate Editors and Editorial office take care of the manuscripts submitted by researchers. IJP is now using the state of the art software provided by Springer for manuscript tracking, reviewer selection and reviewer database. The software is efficient, easy to use and helps to expedite the processes between submission of a manuscript and final decision. Since all editorial processes are controlled by the Editorial team, so there is no chance of compromise of the quality of the journal.

Purpose

Scientific publishing is one of the fastest growing sub-sectors of the media industry. STM market is a stable and reliable field for long-term investments. Considering the vast potential of research output from India, this study may throw light on the prospect of publishing more and more journals in other fields of science from India. Our aim is to find opportunities of publication of new journals following the success routes of IJP. We want to study IJP in the limited period of ten years as a case study as IJP is doing very well in the last few years. We know many factors may influence whether a paper is cited much or little, but these cited numbers are best used to obtain an overview of a researcher's output and overall impact (measured as citation counts per article) of journals in knowledge dissemination.

Objective

The present study has been undertaken with the objective of analyzing the following aspects:

1. Publishing trend
2. Authorship pattern
3. Analysis of citations
4. Affiliated institutes of citing authors
5. Countries of collaborating authors and the collaboration
6. Subject analysis
7. Analysis of the pattern of citing journals

Sources of Information

Indian Journal of Physics, Vol.78 (2004) to Vol. 87 (2013) in both hard copy and soft copy (http://www.iacs.res.in/ijp) is the primary sources of information to collect the data. For the information on citation we have consulted two international online databases namely Science Citation Index (SCI) of ISI Web of Knowledge (http://apps.webofscience.com) and the Scopus Database of Elsevier's SciVerse (http://www.scopus.com/home.url). Besides the Annual Report of the IACS and other related publications of IACS are the main sources of information.

Methodology

The bibliographic records for the analysis are limited to the articles of Indian Journal of Physics published during 2004 -2013. Information regarding citation is collected from WoS and the Scopus Database. These are recorded, tabulated and analysed considering the citation year, cited journals, affiliation of the citing authors and subject area of citation.

Results and Discussion

Table 1. Editors and Impact Factor of IJP

Year	Editor(s)	Impact Factor (IF)
2004	Prof. S. P. Sengupta	-
2005	Prof. J. K. Bhattacharjee	0.072
2006	Prof. J. K. Bhattacharjee	0.195
2007	Prof. J. K. Bhattacharjee	0.265
2008	Prof. S. P. Bhattacharyya	0.175
2009	Prof. S. P. Bhattacharyya	0.226
2010	Prof. D. S. Ray and A. Ghosh	0.291
2011	Prof. A. Ghosh	0.381
2012	Prof. A. Ghosh	1.785
2013	Prof. A. Ghosh	-

Table 1 shows the Impact Factor (IF) of IJP during the period 2005 – 2012 (accessed from www.bioxbio.com/if/html/INDIAN -J-PHYS.html and www.bio21.bas.bg/ibf/IF). The IF of the journal 2004 is not available as it is not included in the said year in Web of Science. When the productivity in terms of the number of articles being published in IJP is concerned, the quantity is going up and at the same time ISI Impact Factor is being maintained, which is treated as the measure for the quality of the articles.

Table 2. Ratio of Articles Published and Cited

Year	Articles Published	Articles Cited	Percentage
2004	245	115	46.93
2005	207	81	39.13
2006	140	49	35.00
2007	106	37	34.90
2008	129	34	26.35
2009	161	96	59.62
2010	185	146	78.91
2011	204	123	60.29
2012	170	113	66.47
2013	189	86	45.50

Table 2 depicts the year wise contribution of articles. It is found that the highest numbers of articles (245) is published in the year 2004; while the least number of articles (106) is brought out in the year 2007. From the Table it is clear that papers published in the year 2010 are cited more (146, 78.91%) during 2010 to March 2014 and papers published in the year 2008 got least citation (34, 26.35%) during the consecutive years 2008 to March, 2014. It is evident that from 2010 onwards the journal is more visible to scientific community and as a result cited more.

Table 3. Frequency of Citations

Year	Citation Year											Total	Avg. Citation per year
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014		
2004	16	38	64	85	60	31	28	26	22	18	8	396	36.00
2005	-	9	40	56	77	44	20	36	23	29	7	341	34.10
2006	-	-	1	26	22	17	25	22	24	22	6	165	18.33
2007	-	-	-	2	10	18	22	16	14	13	4	99	12.38
2008	-	-	-	-	2	25	26	13	15	13	6	100	14.29
2009	-	-	-	-	-	-	39	50	92	87	46	314	62.80
2010	-	-	-	-	-	-	3	65	390	212	33	703	140.00
2011	-	-	-	-	-	-	-	26	267	317	50	660	165.00
2012				-	-	-	-	-	74	348	82	504	168.00
2013	-	-	-	-	-	-	-	-	-	106	117	223	111.50

Table 3 shows a remarkable growth of average citation per article from the year 2010 onwards.

Table 4. Authorship Pattern in Published Papers

Author	Year										Total	%
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013		
Single	35	24	31	12	16	23	17	31	17	18	224	12.90
Two	76	60	41	28	43	32	50	49	38	43	460	26.49
Three	63	52	34	33	31	35	44	43	50	55	440	25.34
Four	24	37	14	20	19	21	27	28	22	29	241	13.88
Five	28	24	12	05	11	27	18	32	27	31	215	12.38
>Five	19	10	08	08	09	23	29	21	16	13	156	8.99
Total	245	207	140	106	129	161	185	184	170	189	1736	100

Table 4 shows authorship pattern of the papers published during the period 2004 to 2013. Out of 1736 papers, the maximum number of papers 460 (26.49%) have been contributed by two authors. This is followed by three authors with 440 papers (25.34%), four authors with 241 papers (13.88%), five authors with 215 papers (12.38%) and more than five authors with 156 papers (8.99%). Table 4 also shows that out of 1736 papers single author contributed 224 papers (12.90%) while the rest 1512 papers (87.10%) contributed by the joint authors. It is clear from the above analysis that percentage of single authored papers is less than that of joint authored papers. To determine the extent of collaboration in quantitative terms, the formula given by K. Subramanyam is used. The formula is as follows:

$C= N_m/N_m+N_s$ where,

C= Degree of Collaboration

N_m= Number of multi authored contributions

N_s= Number of single authored contributions

In the present study the value of C is: 1512/224+1512=0.87. This brings out clearly the prevalence of team research in Physics field.

Table 5. Organisation wise Citation of Articles

Inst	Article Publishing Year									
	2004 (%)	2005 (%)	2006 (%)	2007 (%)	2008 (%)	2009 (%)	2010 (%)	2011 (%)	2012 (%)	2013 (%)
Colleges	82 (22.77)	59 (14.82)	63 (22.26)	60 (20.48)	62 (18.96)	89 (19.26)	132 (22.53)	85 (11.97)	97 (19.06)	95 (17.30)
Universities	187 (51.94)	207 (52.01)	152 (53.71)	156 (53.23)	172 (52.60)	203 (43.94)	271 (46.24)	348 (49.02)	269 (52.85)	257 (46.81)
Research Organiza-tions	89 (24.72)	131 (32.91)	63 (22.26)	73 (24.92)	91 (27.83)	169 (36.58)	181 (30.89)	276 (38.87)	142 (27.90)	195 (35.51)
Others	2 (0.55)	1 (0.25)	5 (1.76)	4 (1.37)	2 (0.61)	1 (0.22)	2 (0.34)	1 (0.14)	1 (0.19)	2 (0.36)
Total	360	398	283	293	327	462	586	710	509	549

Table 5 shows that authors from universities cite most followed by research institutes and colleges.

Table 6. Distribution of subjects

Subjects	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Astrophysics, Atmospheric & Space Physics	12	9	9	12	7	6	18	5	11	11	100
Atomic & Molecular Physics	11	4	6	17	3	7	17	15	7	11	98
Biophysics	4	1	2	3	0	0	0	0	0	2	12
Condensed Matter & Materials Physics	88	104	49	39	88	48	54	23	57	64	614
Nuclear Physics	64	8	9	9	1	56	41	114	14	17	333
Optics & Spectroscopy	16	13	20	4	5	4	17	11	9	6	105
General & Inter-disciplinary Physics	29	46	32	14	7	28	23	24	37	30	270
Nonlinear Dynamics & Complex Systems	5	1	1	1	2	1	1	0	7	19	38
Particle Physics	2	2	7	6	12	9	1	2	8	8	57
Plasma Physics	12	18	4	0	2	2	4	10	15	12	79
Relativity & Cosmology	2	1	0	1	0	0	0	0	4	9	17
Statistical Physics	0	0	1	0	2	0	9	0	1	0	13
Total	245	207	140	106	129	161	185	204	170	189	1736

The subjects of the published articles are categorised as mentioned in the Indian Journal of Physics. Table 6 shows that major contributions are in the field of condensed matter & materials physics followed by nuclear physics and general & interdisciplinary physics. The least contribution is in the field of biophysics as there is no contribution in this field during 2008 to 2012 followed by Statistical Physics. There are specific journals in the field of Biophysics and as a result IJP gets less number of papers in this field. Data in this Table also indicates which branches of physics are attracting more scientists.

Table 7. Geographical Distribution of Contributors

Continents	Year										Total
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	
Africa	0	1	0	0	0	0	8	8	12	14	43
Asia	358	393	281	291	321	442	430	501	463	444	3924
Australia	0	0	0	0	0	0	0	0	2	3	5
Europe	1	3	1	1	4	13	120	154	19	67	383
North America	1	1	1	1	2	7	28	47	13	21	122
Total	360	398	283	293	327	462	586	710	509	549	4477

From Table 7 we find that IJP gets articles from almost all countries and that definitely establish its status of a true international journal. We notice that from 2010 onwards the contributions from outside India have increased remarkably. Major contributing countries are China (153), USA (102), Germany (79), Iran (74), Egypt (61), Italy (54), Russia (52), Turkey (46) etc.

Table 8. Distribution of Cited Journals

Origin	Year										Total
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	
National	51	32	11	17	35	109	529	501	342	155	1782
International	167	165	72	63	52	128	86	67	41	21	862
Total	218	197	83	80	87	237	615	568	383	176	2644

Journals in which articles of IJP are cited are categorised as national and international journals. Table 8 provides the number of citation made in national and international journals. It shows that Journals published from India cite more than journals published from abroad during 2004 to 2013.

Conclusions

In this study we have found that almost all physics journals (total 163) cite articles published in IJP. Notable among them are Physical Review (A, B, C, D), Advances in High Energy Physics, Applied Optics, Astronomy and Astrophysics, Canadian Journal of Physics, Chinese Journal of Physics, Euro Physics Letters, Journal of American Chemical Society, Journal of Chemical Physics, Nanomaterials Nanotechnology, Physics Letters, Thin Solid Film, Journal of Physical Chemistry, Indian Journal of Pure and Applied Physics etc. This definitely establishes that IJP is well accepted amongst the physicists from all over the world. It also proves that IJP disseminates quality knowledge as far as physics research is concerned. One of the major advantages of IJP is that it covers almost all frontier areas of physics research compared to other physics journals those focus only on a particular area. Another plus point of getting more contributions from countries where English is not native language of their own is that IJP is not so rigid as far as language and grammar is concerned without compromising the quality of research.

Although this study is limited to IJP but the results may be useful to similar journals published by universities and learned societies of third world countries. We have found that impact factor, contribution from countries other than India, citation of IJP articles in all major physics journals, national and international collaboration have been improved considerably since 2009. Taking advantage of a commercial publishing house like Springer for online publication and wide circulation through a co-publishing agreement, it has now transformed from an obscure science journal to a well known international physics journal. Authors, editors and reviewers of the journal are taking advantage of the use of fully web-enabled online manuscript submission and review systems of Springer.

We consider industry-institute collaboration that started in 2009 between IACS and Springer is definitely a break through for IJP that improves the quality of the journal in dissemination of quality research in physics. Other factors those play vital roles in improving the quality are the reputation of the journal and the publisher, efficient editorial work, use of online manuscript

tracking system etc. Global presence of Springer and aggressive marketing help the journal to reach many more scientists.

IJP has taken different positive measures to keep this trend of improved quality of the journal. Archiving of back volumes of the journal (1926-2008) and keeping them on-line have been started by keeping the articles in the Institutional Repository (arxiv.iacs.res.in) of IACS that is OAI compliant and interoperable. Articles that are accepted for publication but not yet assigned an issue and volume number is immediately accessible to researchers through "Online First Articles" section of Springer (link.springer.com/journal/12648/onlineFirst). This has increased the chance of getting more citations of their works. Editorial office has extended support to the authors to improve the language of the articles that originate from the countries where English is not native language of their own.

References

Arkhipov, D. B. (1999). Scientometric analysis of Nature, the journal. Scientometrics, 46(1), 51-72.

Das, A. and Sen, B. K. (2001). Indian journal of medical research: an analysis of citation pattern. *ILA Bulletin*, 37, 9-12.

Garg, K. C. and Kumar, S. (2010). An analysis of the citation pattern of Indian Science journals indexed by SCIE. *Annals of Library and Information Studies*, 57, 365 372.

Kumar, A. and others (2008), Pramana – Journal of Physics: A scientometrics analysis. *Annals of Library and Information Studies*, 55, 201-211.

Mahapatra, G. (1994). Indian library and information journals: a bibliometric analysis of the rate of citation and their characterises, *Library Review*, 43, 41-46.

Paul, G. and Das, A. (2012). Impact of Indian Journal of Physics in knowledge dissemination. In *Information and Knowledge Dissemination: Present Status and Future Direction* (pp. 173-181). Kolkata: Allied Publishers.

Ramesh L S R C V and Nagaraju, A V S S (2000). Citation analysis of the Indian Journal of Information, Library and Society. Indian Journal of Information, Library and Society, 13 (3-4), 171-179.

Singh, J. K. (2014). A scientometric analysis of "Indian Journal of Pure and Applied Physics" (2006-2010): a study based on Web of Science. *Research Journal of Library Science*, 2(1), 7-12.

Sivasekaran, K and Ragavan S. S. (2014). Journal of Astrophysics and Astronomy : A Bibliometric Study. e-Library Science Research Journal, 2(6), 1-5.

Subramanian, K. (1983). Bibliometric studies of research collaboration: A review. Journal of Information Science, 6(1), 33-38.