Astrophysical Journal during 2001-2013: A Scientometric Study

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Abstract

This paper analyses the results of a scientometric study of the research activities of Astrophysical Journal during 2001 to 2013. The study evaluates the growth of publications, citations, average citations per publication and H- index of top scientists/researchers, research organizations, funding agencies and countries in the Astrophysical journal during 2001-2013 as per web of science database. The data was coded and tabulated with the help of various Scientometric techniques. The outcome showed that there is significant growth in the productivity of astrophysical journal during 2001-2013.

Keywords

Scientometric; Astrophysical Journal: Web of Science; Scientific Collaboration; Productivity.

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INTRODUCTION

As human beings all of us are very curious about the stars, planets, galaxies, nebula and other objects in the universe. NASA, ISRO and other organizations were dedicated to the cause of Astronomy or Astrophysics. Astrophysics is the branch of space science that applies the laws of physics and chemistry to explain the birth, life and death of stars, planets, galaxies, nebula and other objects in the universe.

The Astrophysical Journal is the peer-reviewed and foremost research journal in the world devoted to recent developments, discoveries, and theories in astronomy and astrophysics. Many of the classic discoveries of the 20th century have first been reported in the Journal and its impact factor is 6.733 (2012). The Astrophysical journal was founded in 1895 by American astronomers George E. Hale and James E. Keeler.

When single journal is studied scientometrically it creates a portrait of the journal providing a description that offers an insight that is beyond the superficial. It can indicate the quality, quantity, maturity and productivity of the journal. Scientometrics can be defined as "quantitative study of science, communication in science and science policy'' in other words 'the science of studying and analyzing science is called scientometrics'. Scientific collaboration is viewed as a virtue, so much so that several public policies actively encourage scientific collaboration at both the individual and institutional levels. The present study attempts to bring out the growth and trajectory of the Astrophysical journal.

NEED FOR THE STUDY

The journals are the main indicators of literature growth in any field. Periodicals emerge as the main channel for disseminating knowledge in the information led society. Information explosion or literature growth has become major challenge for scientists, researchers and scholars because they have to be updated with resent development in their respected field. Scientometric techniques are major tool for assessment of research activity.

OBJECTIVES

The specific objectives of the study are:

1. To analyze the year-wise growth of publications and citations.
2. To analyze the document type-wise distribution of publications.

3. To identify the highly productive scientists/researchers and citations.
4. To identify the top organizations/institutions-wise publications and citations.
5. To know the top funding agency-wise publications and citations.
6. know the top country-wise publications and citations.

METHODOLOGY

For the present study 'Astrophysical journal during 2001-2013: Scientometric study' Web of Science database *[www.isiknowledge.com]* during 2001-2013 has been used. Web of Science is online subscription based citation indexing service maintained by Thompson Reuters. It provides the core collection of researchers, administrators, faculty, and students with quick, powerful access to the world's leading citation databases. Authoritative, multidisciplinary content covers over 12,000 of the highest impact journals worldwide, including Open Access journals and over 150,000 conference proceedings.

The publications, citations, H-index of 13 years (2001-2013) have been taken for the study, status and progress of the Astrophysical Journal.

RESULTS AND DISCUSSION

Growth and Distribution of Publications and Citations

The table 1 shows the year-wise growth and distribution of publications and citations of Astrophysical Journal. A total number of 34222 publications were published in the journal by scientists and researchers during 2001 to 2013 as per as Web of Science database. These publications received total 1127475 citations with 33.74 average citations per publication. Highest numbers of publications 3115(9.10%) were published in the year 2012, while lowest numbers of publications 2163 (6.32%) were published in the year 2008, whereas average publications per year was 2632; highest number of citations were received (137226) in the year 2001, while lowest citations (12033) were received in the year 2013, whereas average citations per year was 86728. It is observed from the table that older publications tend to receive more citations than latest publications .

Table 1: Growth and Distribution of Publications and Citations

Year	Total Publications (TP)	Percentage	Total Citations (TC)	Average Citations Per Publication (ACP)
2001	2545	7.44	137226	53.92
2002	2327	6.80	116610	50.11
2003	2470	7.22	125300	50.73
2004	2511	7.34	119914	47.76
2005	2623	7.66	115360	43.98
2006	2823	8.25	114717	40.64
2007	2838	8.29	105352	37.12
2008	2163	6.32	70771	32.72
2009	2824	8.25	79351	28.10
2010	2538	7.42	57341	22.59
2011	2508	7.33	41674	16.62
2012	3115	9.10	31826	10.22
2013	2937	8.58	12033	4.10
Total	**34222**	**100**	**1127475**	**33.74**

Distribution of Publications according to Document Types

The table 2 depicts the distribution of publications according to document types in the journal. In the total 34222 publications during 2001-2013, 32698 (95.55%) publications were in the form of articles, while 1069 (3.12%) were in the form of reviews. It is observed that highest share of publications are in the form of articles, whereas only 7 (0.02%) were published in the form of editorial materials (Fig. 2).

Sl. No.	Document Types	Publications	Percentage
1	Article	32698	95.55
2	Review	1069	3.12
3	Correction	448	1.31
4	Editorial Material	7	0.02
Total		**34222**	**100.00**

Table 2: Document Types

Highly Productive Scientists/Researchers

Table 3 reveals the highly productive scientists/researchers of the journal, based on the numbers of publications during 2001 to 2013. These scientists/researchers have published 3623 publications and received 202800 citations with average citations per paper of 54.66%. Gehrels, N. is the highly productive author; he contributed 216 publications followed by Schneider, D.P. with 196 publications, while Filippenko, A.V. comes next with 188 publications. In terms of citations Filippenko, A.V. is having highest citations i.e. 17276 and he has 91.9 average citations per paper, followed by Schneider, D. P. received15985 citations with 81.6 average citations per paper. It is observed that if Gehrels, N. is having highest publications, whereas Filippenko, A. V is received highest citations

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Table 3: Highly Productive Scientists/ Researchers and Citations

Rank by TP	Rank by TC	Rank by ACP	Authors	TP	TC	ACP	H-Index
1	4	12	Gehrels, N.	216	12118	56.1	56
2	2	2	Schneider, D.P.	196	15985	81.6	62
3	1	1	Filippenko, A.V.	188	17276	91.9	63
4	3	5	Rix, H.W.	168	12224	72.8	63
5	24	24	Henning, T.	155	3790	24.5	35
6	6	6	Franx, M.	152	10647	70.1	62
7	19	21	Kochanek, C. S.	147	5781	39.3	40
8	13	14	Rich, R. M.	144	7513	52.2	48
9	9	10	Kulkarni, S. R.	142	8351	58.8	49
10	16	18	Torres, D. F.	142	6605	46.5	45
11	5	3	Hernquist, L.	140	11372	81.2	61
12	7	4	Rieke, G. H.	138	10128	73.4	56
13	10	9	Marcy, G. W.	138	8317	60.3	53
14	12	11	Brandt, W. N.	137	7874	57.5	50
15	15	17	Jones, C.	137	6732	49.1	42
16	11	8	Ho, L. C.	134	8176	61.0	48
17	25	25	Ho, P. T. P.	134	3051	22.8	31
18	14	13	Zhang, B.	133	7296	54.9	49
19	8	7	Stern, D.	132	8477	64.2	49
20	20	20	Prochaska, J. X.	129	5449	42.2	42
21	17	16	Longo, F.	128	6444	50.3	44
22	23	23	Gaensler, B. M.	127	3810	30.0	36
23	18	15	Murray, S. S.	123	6329	51.5	43
24	22	22	Gould, A.	122	3897	31.9	32
25	21	19	Johnson, J. A.	121	5158	42.6	42

TP= Total Publications, TC= Total Citations, ACP= Average Citations per Publications

Research output of Top Organizations/Institutions

The table 4 brings out the top organizations/institutions-wise distribution of publications in the journal during 2001-2013. These top organizations/institutions have contributed total 49524 publications together, with 2148837 total citations. University of California system (USA) top the list with 5344 publications, followed by National Aeronautics Space Administration (NASA) from USA with 4354 publications, while Smithsonian Institution (USA) having 3915 publications. In terms of Citations University of California System (USA) top the list with 243800 citations, followed by California Institute of Technology (USA) with 177973 citations, while Smithsonian Institution is having 165534 citations. It is observed that

organization/Institutions from USA were having greater share in the productivity.

Table 4: Research output of Top Organizations/Institutions

Rank By TP	Rank By TC	Rank by ACP	Research Organizations/Institutions	Country	TP	TC	ACP	H-Index
1	1	13	University of California System	USA	5344	243800	45.62	180
2	4	19	National Aeronautics Space Administration (NASA)	USA	4354	160026	36.75	143
3	3	16	Smithsonian Institution	USA	3915	165534	42.28	156
4	2	8	California Institute of Technology	USA	3649	177973	48.77	170
5	5	14	Max Planck Society	Germany	3131	136835	43.70	153
6	10	22	Goddard Space Flight Center	USA	2464	81416	33.04	109
7	6	3	University of California Berkeley	USA	2205	116958	53.04	143
8	7	6	University of Arizona	USA	2013	98953	49.16	137
9	9	10	United States Department of Energy DoE	USA	1780	83064	46.67	121
10	8	7	Space Telescope Science Institute	USA	1780	87480	49.15	117
11	11	4	University Of California Santa Cruz	USA	1476	77301	52.37	122
12	18	21	Centre National De La Recherche Scientifique (CNRS)	France	1459	50137	34.36	94
13	14	9	Pennsylvania Commonwealth System of Higher Education (PCSHE)	USA	1426	66886	46.90	115
14	13	5	Johns Hopkins University	USA	1410	73099	51.84	121
15	20	20	University System of Maryland	USA	1361	48477	35.62	93
16	12	1	Princeton University	USA	1276	75438	59.12	129
17	16	12	Penn State University	USA	1244	57089	45.89	105
18	23	23	National Institutes of Natural Sciences (NINS)	Japan	1214	36684	30.22	87
19	25	25	Chinese Academy of Sciences	China	1214	21285	17.53	59
20	24	24	National Astronomical Observatory of Japan	Japan	1204	36263	30.12	85
21	22	18	University of Tokyo	Japan	1142	45246	39.62	88
22	15	2	University of Chicago	USA	1130	61980	54.85	120
23	21	17	Jet Propulsion Laboratory	USA	1117	46990	42.07	101
24	19	15	Massachusetts Institute of Technology (MIT)	USA	1111	48544	43.69	102
25	17	11	University of Hawaii System	USA	1105	51379	46.50	97

Top Funding Agencies Publication and Citations

The table 5 lists the top funding agencies which provided funds for the publication of articles in the journal during 2001 to 2013. These agencies have funded for 16466 publications together with total 302060 citations. National Aeronautics Space Administration (NASA) from USA has funded 5694 publications with 105349 citations, followed by National Science Foundation (USA) which is having 4308 publications and 81203 citations, whereas Department of Energy (USA) is funded for 672 publications and 14275 citations. It is observed that funding agencies from USA is having top share followed by England and Germany.

Table 5: Top Funding Agencies Publications and Citations

Rank by TP	Rank by TC	Rank by ACP	Funding Agencies	Country	TP	TC	ACP	H Index
1	1	10	National Aeronautics And Space Administration (NASA)	USA	5694	105349	18.5	96
2	2	8	National Science Foundation (NSF)	USA	4308	81203	18.85	87
3	3	3	Department of Energy (DOE)	USA	672	14275	21.24	55
4	4	9	Alfred P Sloan Foundation	USA	549	10314	18.79	46
5	10	25	National Natural Science Foundation (NSFC)	China	532	5565	10.46	31
6	6	5	Max Planck Society	Germany	445	8830	19.84	46
7	5	2	W M Keck Foundation	USA	424	10175	24.00	48
8	7	6	Japanese Monbukagakusho	Japan	395	7706	19.51	43

9	9	7	Higher Education Funding Council for England	England	338	6476	19.16	40
10	8	1	Space Telescope Science Institute (STScI)	USA	287	7151	24.92	46
11	11	4	Science & Technology Facilities Council (STFC)	India	234	4706	20.11	35
12	12	12	Princeton University	USA	218	3693	16.94	30
13	15	21	Natural Sciences and Engineering Research Council (NSERC)	Canada	216	3165	14.65	25
14	13	17	Australian Research Council	Australia	213	3316	15.57	31
15	14	16	University of Chicago	USA	200	3229	16.15	29
16	17	20	University of Washington	USA	198	2908	14.69	28
17	19	24	Johns Hopkins University	USA	197	2836	14.40	27
18	18	19	New Mexico State University	USA	193	2841	14.72	28
19	16	13	Smithsonian Institution	USA	180	3044	16.91	29
20	22	22	University of Portsmouth	England	177	2585	14.60	25
21	24	23	Ohio State University	USA	173	2502	14.46	25
22	20	14	Institute for Advanced Study	USA	160	2692	16.83	27
23	25	18	University of Cambridge	England	156	2341	15.01	24
24	23	15	Fermi National Accelerator Laboratory (FERMILAB)	USA	154	2544	16.52	27
25	21	11	University of Pittsburgh	USA	153	2614	17.08	26

Top country-wise Productivity

The table 6 depicts the country-wise distribution of articles published in the journal during 2001 to 2013. USA is top ranked with 26050 (76.12%) publications, followed by Germany with 4901 (14.32%) publications, while England ranked third with 4062 (11.87%) publications. It is observed that India is ranked 20th position with 655 (1.91%) publications. It is also observed that USA tops the list, followed by Germany, England and Japan.

Table 6: Top country-wise productivity

Sl. No.	Country	Publications	Percentage
1	USA	26050	76.12
2	Germany	4901	14.32
3	England	4062	11.87
4	Japan	3329	9.73
5	Italy	3066	8.96
6	Canada	2866	8.38
7	France	2717	7.94
8	Spain	2077	6.07
9	China	2059	6.02
10	Australia	1939	5.67
11	Netherlands	1584	4.63
12	Chile	1285	3.76
13	Switzerland	872	2.55
14	South Korea	862	2.52
15	Israel	809	2.36
16	Mexico	747	2.18
17	Russia	731	2.14
18	Taiwan	710	2.08
19	Scotland	705	2.06
20	India	655	1.91
21	Poland	614	1.79
22	Sweden	552	1.61
23	Denmark	527	1.54
24	Brazil	420	1.23
25	Belgium	355	1.04

CONCLUSION

Research is a complicated process involving very often a large number of intricate issues. Evaluation is one of the key components of any research and development activity. There are many measures of scientific productivity of research output and impact. Publication and citation counting techniques have been used in the assessment of scientific activity. Scientometric techniques are very important tools for analyzing research performance. Citation analysis constitutes an important tool in quantitative studies of science and technology. To assess the quality of a given publication, the number of times it has been cited in the literature can be counted. The prime purpose of the present study is to portrait the growth and development of the Astrophysical journal using various scientometric techniques. Astrophysical journal has published the 34222 publications during 2001 to 2013. The publications received total 1127475 citations with 33.74 average citations per publication.

The outcome conforms that there is considerable growth in the productivity of the journal during 2001-2013. The result also proved that Astrophysical journal is one of the leading journals in the field of astrophysics.

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