

Pramana - Journal of Physics: A scientometric analysis

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Focuses on publishing trend; impact factor; authorship pattern; types of articles; institutional collaboration of authors; affiliated institutions of authors; countries of contributing authors; keyword analysis; and referencing pattern. The number of articles being published in *Pramana* and its ISI impact factor are increasing. There is an upward trend in number of collaborated papers. Authors from University of Delhi, Delhi; Bhabha Atomic Research Centre, Mumbai; Physical Research Laboratory, Ahmedabad; Institute of Physics, Bhubaneswar; Indian Institute of Science, Bangalore; Tata Institute of Fundamental Research, Mumbai etc. contributed most number of articles. One fourth of the total articles published in *Pramana* are from outside India, the host country of the journal and the number of articles submitting from other countries is also increasing. Cosmology; supersymmetry; chaos; quantum chromodynamics; phase transition; and quark-gluon plasma are the leading micro-fields of physics to which maximum number of articles published in *Pramana*. The average number of references per article is found as 21.85 and it is 104.4 when the average is taken only for review articles.

Introduction

Printed academic journals are the major avenues through which scientists communicate their scientific results with each other, their opinions, and many times exchange observations¹. Scientific journals are the means by which the scientific community certifies accumulations and additions to its body of accepted knowledge and the means through which scholars are competing²⁻³.

Individual journals have been the focus of many bibliometric and scientometric studies. The journal 'Nature' has been studied for its multi-disciplinarity⁴ and a scientometric study to reveal the key trends in the development of basic science through 'Nature'⁵. The studies by Rice et. al.; Harper; Ramesh and Nagaraju; Lal; Kalyane and Sen; Adithya Kumari and Shivaram Rao; Ghosh; Ullah; Raina; Deo; Sivasubramanian; Suryanarayana; Tiew; Tiew and Kaur; Tatlow; Cracknell are examples of simple bibliometric and scientometric analyses of individual journals for various periods⁶⁻²³.

Hoffman and Holbrook have done author's co-citation analysis for the journal 'Journal of Consumer Research'²⁴. Nalini has discussed the impact factor of

Indian Journal of Occupational Health, a non-SCI journal²⁵. Swarna et al attempted to observe the characteristics of hyperlinks provided in the articles of the journal *Library Philosophy and Practice*, an electronic free access journal²⁶⁻²⁷. Prakasan et al have made an attempt to study the accessibility, temporality and volatility of links in the articles of three library and information science e-journals viz., *Information Research: An International Electronic Journal*, *LIBRES: Library and Information Science Research Electronic Journal*, and *Library Philosophy and Practice*²⁸.

Pramana, in Sanskrit language means a source of valid knowledge, a standard, etc. *Pramana - Journal of Physics* (hereafter referred to as only *Pramana*), a monthly journal in the field of physical sciences, was started in July 1973 by the Indian Academy of Sciences, Bangalore, India in collaboration with Indian Physics Association and the Indian National Science Academy. In the beginning, the published articles were mainly devoted to the sub-fields like cosmic physics, solid state physics, molecular physics, biophysics, etc. The journal publishes refereed papers covering current research in physics, both original research articles and invited reviews. *Pramana* also publishes special issues devoted

to (a) advances in specific areas of physics and (b) proceedings of select high quality conferences. The earlier Editors of *Pramana* in charge to date²⁹, their service periods and the average Impact Factor assigned by the Institute for Scientific Information (ISI), Philadelphia, in those periods are given in Table 1.

There are very few bibliometric/scientometric studies conducted on *Pramana*. Sharma had conducted one study exclusively focusing on *Pramana*³⁰. The study reported the thematic structure of *Pramana* based on factor analysis in conjunction with multidimensional scaling and tracked the thematic changes that have taken place over the two time spans, 1984 and 1994. As *Pramana* is a prominent physics journal of India with a current Impact Factor of 0.417 (Impact Factor-2006), there is a need to examine, evaluate and document the analysis of the scientometric parameters of the journal in detail.

Methodology

The bibliographic records for the analysis are limited to the articles of *Pramana* published during 1982-2006 and included in the CD-ROM version of *Science Citation Index* (SCI) of ISI.

Results and Discussion

Publishing trend and Impact Factor

During the period 1982-2006, *Pramana* has published 3976 articles with a yearly average of 159.04 articles; a minimum of 88 (1996) and a maximum of 307 articles (2004). The upward steady growth in number of articles published in *Pramana* observed from Figure 1 shows its increasing popularity among physicists. The smooth cumulative curve in Figure 1 and the Impact Factors from 1982 onwards as seen in Figure 2 implies that *Pramana* has maintained upward trend throughout the period with

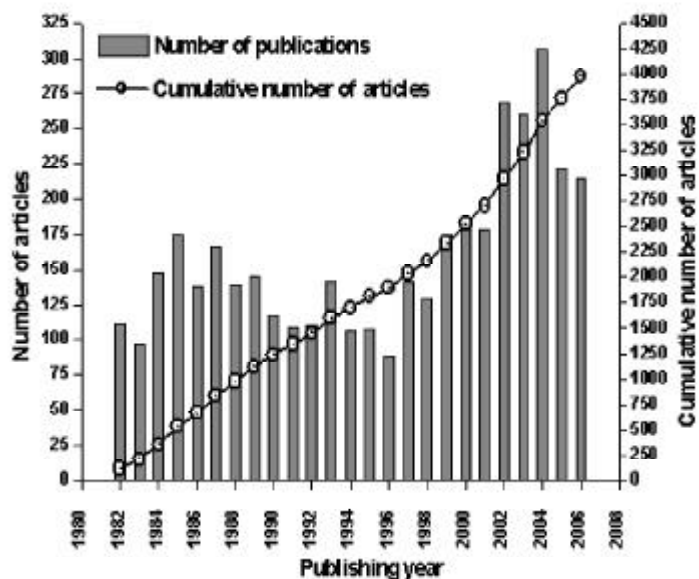


Fig. 1 – No. of articles published in *Pramana* during 1982-2006

respect to the number of articles published and at the same time it has maintained the Impact Factor almost at same level.

Authorship pattern

Figure 3 represents the authorship pattern observed in the articles published in *Pramana* during 1982-2006. There are a total of 11795 authorships observed in *Pramana* during the period with a maximum of 308 authorships in two articles (PHENIX collaboration articles). Collaboration rate is defined as the ratio of number of multi-authored articles with the total number of articles. Collaboration rate was 0.70. Articles written in collaboration by two authors (31.24 %) are found to be predominant followed by single authors (30.03 %); collaboration of three authors (18.89 %); four authors (8.70 %) etc.

Types of articles

The *Science Citation Index* database has categorised the nature of the articles published in *Pramana* as shown in Table 2. Among the types of articles, Research Articles (92.15%) are well ahead of all other types of articles followed by Notes (2.46%), Editorial-Materials (1.71%), and Letters (1.36%). These four categories constitute more than 97% of the articles.

Institutional collaboration

Affiliations of authors given in the byline of the articles were analysed and it was found that 65.57 per cent of

Table 1 – Editors of *Pramana*, their periods and average ISI impact factors of that periods

Editors	Period	Mean Impact Factor
S. Ramaseshan	1982-1983	0.29
E.S. Raja Gopal	1984-1989	0.43
R. Rajaraman	1990-1992	0.37
Rajaram Nityananda	1993-1997	0.35
H.R. Krishnamurthy	1998-2006	0.32

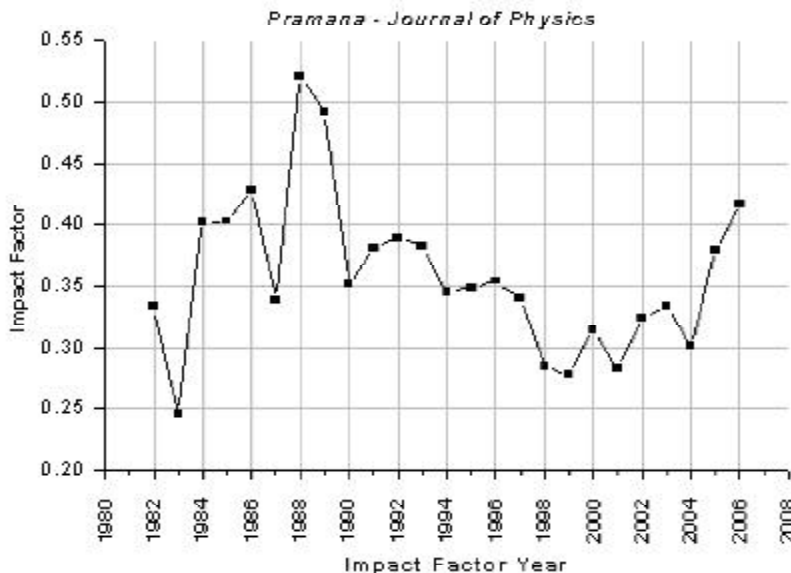


Fig. 2 — Fluctuations in ISI Impact Factors of *Pramana* during 1982 -2006

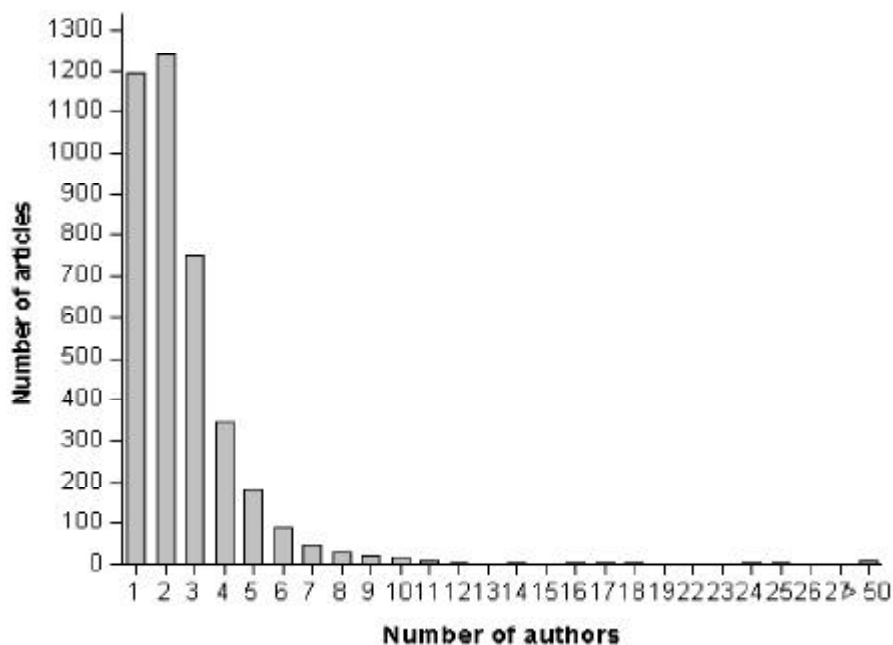


Fig. 3 — Authorship pattern observed in the articles of *Pramana* (1982-2006)

articles are from authors with single affiliation and there is a maximum collaboration of 46 institutions in an article³¹. Table 3 shows the pattern of institutional collaborations among the authors.

Affiliated institutions of authors

The analysis of the affiliation of authors of the articles under consideration shows institutes/organisations from

India that have appeared on top of the list. First 23 ranks are occupied by institutes/organisations from India. A total of 30277 individual institutions/organisations have appeared as affiliations of the authors who have contributed articles to *Pramana* and among them 1337 (0.44 %) are from outside India. University of Delhi, Dept Phys & Astrophys, Delhi tops the list (Table 4) among the affiliations of the authors. The next five ranks go to: Bhabha Atomic Research Centre, and so on

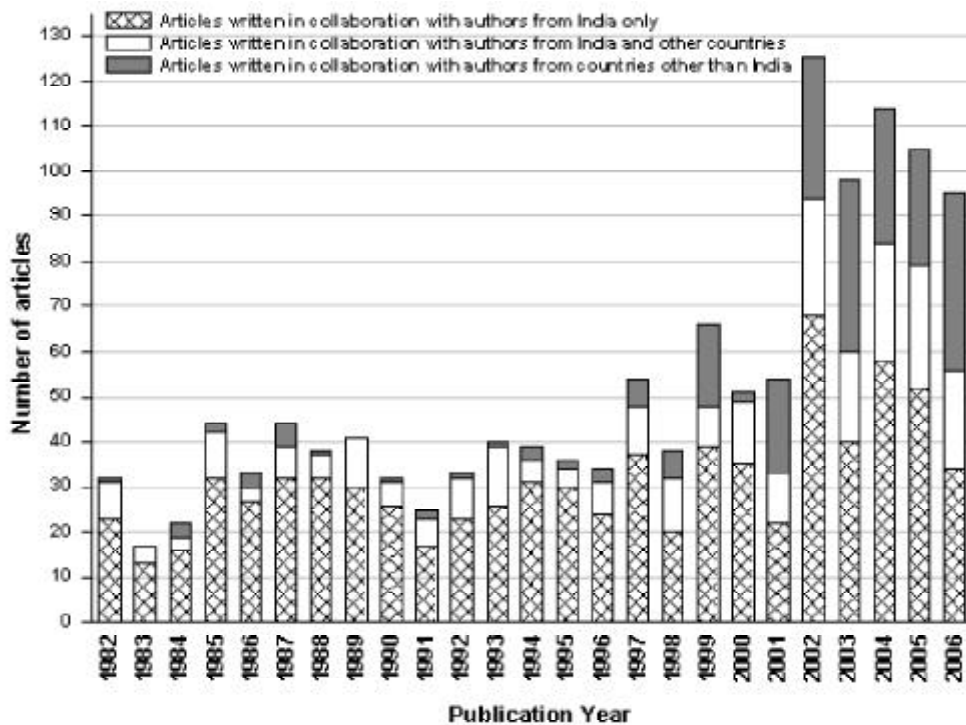


Fig. 4 — Trend of collaboration of authors from various countries observed in the articles published in *Pramana* during 1982-2006

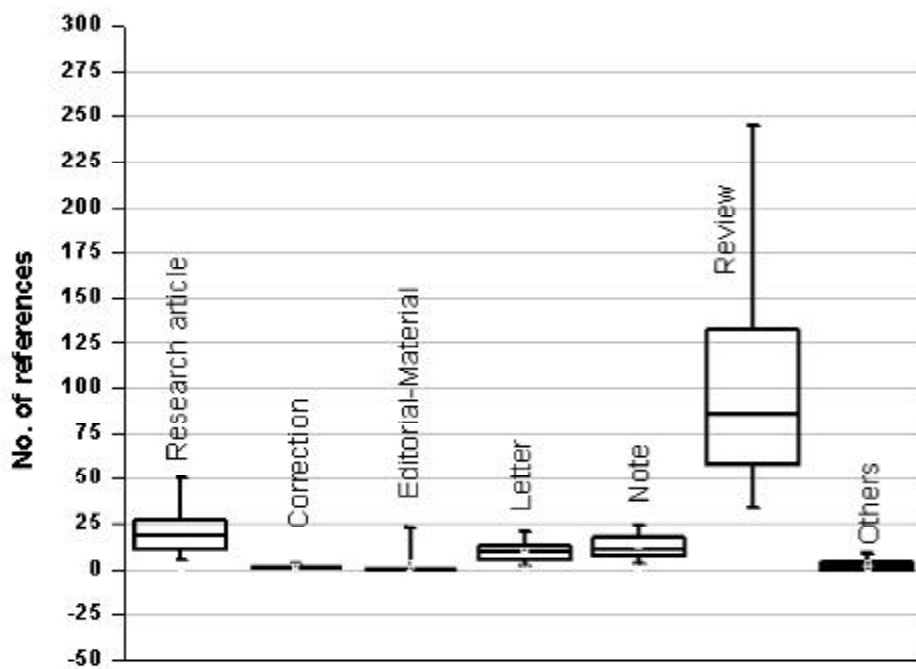


Fig. 5 — Variation in number of references in different types of articles published in *Pramana* during 1982-2006

Table 2 — Types of articles published in *Pramana* during 1982-2006

Type of article	No. of articles	% of total	Cumulative %
Research Articles	3664	92.15	92.15
Notes	98	2.46	94.62
Editorial-Materials	68	1.71	96.33
Letters	54	1.36	97.69
Reviews	34	0.86	98.54
Corrections	32	0.80	99.35
Meeting-Abstracts	16	0.40	99.75
Editorials	8	0.20	99.95
Biographical-Items	1	0.03	99.97
Reprints	1	0.03	100.00
Total	3976	100.00	

Countries of contributing authors and the collaboration

Table 5 shows the analysis of the countries in the affiliations of the authors who contributed articles to *Pramana* during 1982-2006. A total of 73 countries occurred in the affiliations of authors. It was found that around three fourth of the total affiliations are from India. The rest of the countries constitute 28.30 % and among them, USA (7.12 %) leads followed by Italy (2.23 %); France (2.18 %); Germany (2.16 %); Japan (2.02 %) etc.

The present study has categorised three levels of collaboration of authors from different countries with in the 1310 collaborated articles, viz. 1) collaboration of authors from countries other than the host country (India); 2) collaboration of authors from India and other countries; and 3) collaboration of authors from India only. The trend of the collaboration is diagrammatically shown in Figure 4. It has been evidenced from the figure that there is an increase in number of collaborative articles. There is a drastic increase in number of articles written in collaboration by authors from countries other than India in the recent past. Whereas the number of articles written in collaboration by authors from India and other countries; and collaboration of authors from only India remained steady in these years.

Keyword analysis

The analysis of keywords occurring in the 'author keywords' and 'KeyWords Plus' fields of the *Science*

Table 3 — Collaboration pattern of Institutional affiliations of authors observed in the articles published in *Pramana* during 1982-2006

Number of affiliations	No. of articles	Total affiliations
1	2607	2607
2	902	1804
3	282	846
4	68	272
5	22	110
6	9	54
7	5	35
8	3	24
9	3	27
10	2	20
11	2	22
12	2	24
13	1	13
15	1	15
17	2	34
19	2	38
20	2	40
23	1	23
46	1	46
Without affiliation	59	0

Citation Index was carried out to examine the nature of contents of the articles. There are a total of 5835 unique keywords assigned by authors of the articles and 4904 keywords from KeyWordPlus observed in the records analysed. Table 6 is the truncated list of keywords with their number of occurrence in the records analysed. The researchers, who contributed to *Pramana*, have more focused on the physics micro-domains like: cosmology; supersymmetry; chaos; quantum chromodynamics; phase transition; and quark-gluon plasma when the author keywords are concerned. As far as KeyWordPlus is concerned model; dynamics; systems; scattering; transition; and collisions are the highly occurred.

Referencing pattern

References in an article show the depth of the micro-area in which the article is written. Review articles

Table 4 — Highly occurred (more than or equal to 15 times) affiliations of authors of the articles published in *Pramana* during 1982-2006

Rank	Institutions/orgnisations	Occurrence in affiliations of the authors
1	UNIV-DELHI, DEPT PHYS & ASTROPHYS, DELHI 110007, INDIA	59
2	BHABHA ATOM RES CTR, DIV NUCL PHYS, BOMBAY 400085, INDIA	52
2	BHABHA-ATOM-RES-CTR, DIV SOLID STATE PHYS, BOMBAY 400085, MAHARASHTRA, INDIA	52
3	PHYS-RES-LAB, AHMEDABAD 380009, GUJARAT, INDIA	48
4	INST-PHYS, BHUBANESWAR 751005, ORISSA, INDIA	47
5	INDIAN INST SCI, DEPT PHYS, BANGALORE 560012, KARNATAKA, INDIA	43
5	TATA-INST-FUNDAMENTAL-RES, BOMBAY 400005, MAHARASHTRA, INDIA	43
6	INDIAN-INST-SCI, DEPT PHYS, BANGALORE 560012, KARNATAKA, INDIA	40
7	TATA-INST-FUNDAMENTAL-RES, HOMI BHABHA RD, BOMBAY 400005, MAHARASHTRA, INDIA	38
8	INDIAN-INST-TECHNOL, DEPT PHYS, KANPUR 208016, UTTAR-PRADESH, INDIA	35
9	TATA INST FUNDAMENTAL RES, HOMI BHABHA RD, BOMBAY 400005, MAHARASHTRA, INDIA	33
10	BHABHA-ATOM-RES-CTR, DIV NUCL PHYS, BOMBAY 400085, MAHARASHTRA, INDIA	32
10	INDIAN INST TECHNOL, DEPT PHYS, KANPUR 208016, UTTAR PRADESH, INDIA	32
11	BANARAS HINDU UNIV, DEPT PHYS, VARANASI 221005, UTTAR PRADESH, INDIA	29
11	BANARAS-HINDU-UNIV, DEPT PHYS, VARANASI 221005, UTTAR-PRADESH, INDIA	29
12	INDIAN-INST-TECHNOL, DEPT PHYS, BOMBAY 400076, MAHARASHTRA, INDIA	26
13	JAWAHARLAL-NEHRU-UNIV, SCH PHYS SCI, NEW-DELHI 110067, INDIA	25
13	TATA INST FUNDAMENTAL RES, BOMBAY 400005, INDIA	25
14	INST-MATH-SCI, MADRAS 600113, TAMIL-NADU, INDIA	24
14	PANJAB-UNIV, DEPT PHYS, CHANDIGARH 160014, INDIA	24
14	SAHA-INST-NUCL-PHYS, CALCUTTA 700064, W-BENGAL, INDIA	24
15	INDIAN-INST-TECHNOL, DEPT PHYS, MADRAS 600036, TAMIL-NADU, INDIA	23
16	INDIAN-INST-SCI, CTR THEORET STUDIES, BANGALORE 560012, KARNATAKA, INDIA	21
16	PHYS RES LAB, AHMEDABAD 380009, GUJARAT, INDIA	21
16	UNIV-RAJASTHAN, DEPT PHYS, JAIPUR 302004, RAJASTHAN, INDIA	21
16	UTKAL UNIV, DEPT PHYS, BHUBANESWAR 751004, ORISSA, INDIA	21
17	UNIV DELHI, DEPT PHYS & ASTROPHYS, DELHI 110007, INDIA	20
18	CTR-NUCL-SCI, NEW-DELHI 110067, INDIA	19
18	JADAVPUR-UNIV, DEPT PHYS, CALCUTTA 700032, W-BENGAL, INDIA	19
18	UNIV RAJASTHAN, DEPT PHYS, JAIPUR 302004, RAJASTHAN, INDIA	19
18	UNIV-HYDERABAD, SCH PHYS, HYDERABAD 500046, ANDHRA-PRADESH, INDIA	19
19	INDIAN INST TECHNOL, DEPT PHYS, MADRAS 600036, TAMIL NADU, INDIA	18
19	UTKAL-UNIV, DEPT PHYS, BHUBANESWAR 751004, ORISSA, INDIA	18
20	INST PHYS, BHUBANESWAR 751005, INDIA	17

Contd..

20	UNIV-ROORKEE, DEPT PHYS, ROORKEE 247667, UTTAR-PRADESH, INDIA	17
21	TATA-INST-FUNDAMENTAL-RES, BOMBAY 400005, INDIA	16
22	BHABHA ATOM RES CTR, DIV SPECT, BOMBAY 400085, INDIA	15
22	PHYS-RES-LAB, THEORY GRP, AHMEDABAD 380009, GUJARAT, INDIA	15
22	SARDAR-PATEL-UNIV, DEPT PHYS, VALLABH-VIDYANAGAR 388120, GUJARAT, INDIA	15
22	TATA INST FUNDAMENTAL RES, HOMI BHABHA RD, BOMBAY 400005, INDIA	15

(truncated)

Table 5 — Countries in the affiliations of the authors of the articles published in *Pramana* during 1982-2006

Country	No. of times occurred in affiliations	Country	No. of times occurred in affiliations
INDIA	4341	FINLAND	8
USA	431	CZECH-REPUBLIC	6
ITALY	135	SINGAPORE	6
FRANCE	132	MALAYSIA	5
GERMANY	131	AZERBAIJAN	4
JAPAN	122	BULGARIA	4
ENGLAND	62	DENMARK	4
SWITZERLAND	47	PAKISTAN	4
RUSSIA	46	ARMENIA	3
USSR	42	CHILE	3
PEOPLES-R-CHINA	32	SAUDI-ARABIA	3
TURKEY	32	SCOTLAND	3
POLAND	31	UZBEKISTAN	3
SPAIN	31	WALES	3
ISRAEL	29	ALGERIA	2
MEXICO	25	BYELARUS	2
AUSTRALIA	24	COLOMBIA	2
TAIWAN	23	ETHIOPIA	2
CANADA	21	GREECE	2
BANGLADESH	20	INDONESIA	2
IRAN	20	LESOTHO	2
EGYPT	18	THAILAND	2
SOUTH-AFRICA	18	YUGOSLAVIA	2
PORTUGAL	17	CROATIA	1
AUSTRIA	15	CZECHOSLOVAKIA	1
SOUTH-KOREA	13	IRAQ	1
SWEDEN	13	IRELAND	1
BELGIUM	12	JAMAICA	1
NETHERLANDS	12	KENYA	1
BRAZIL	11	LITHUANIA	1
FED-REP-GER	11	MOROCCO	1
NIGERIA	11	NEW-ZEALAND	1
ROMANIA	10	NIGER	1
HUNGARY	9	SLOVAKIA	1
NORTH-IRELAND	9	SRI-LANKA	1
ARGENTINA	8	URUGUAY	1

Table 6 — Most occurred 30 keywords (both Author assigned keywords and Keyword Plus as per *Science Citation Index*) associated with the articles published in *Pramana* during 1982-2006

Author assigned keywords	No. of times occurred	KeywordPlus	No. of times occurred
Cosmology	55	Model	94
Supersymmetry	48	Dynamics	69
Chaos	36	Systems	67
Quantum Chromodynamics	29	Scattering	53
Phase Transition	25	Transition	41
Quark-Gluon Plasma	24	Collisions	40
Cp Violation	21	QCD	39
Neutron Scattering	20	States	34
Superconductivity	20	Behavior	31
Neutron Diffraction	19	Decay	30
Quark Gluon Plasma	18	Matter	30
General Relativity	17	Phase	30
Heavy-Ion Collisions	17	Spectroscopy	30
Neutrino	15	Temperature	29
Ionization	14	Fluctuations	28
Small-Angle Neutron Scattering	14	State	27
Standard Model	14	Mass	24
Colossal Magnetoresistance	13	Energy	23
X-Ray Diffraction	13	Field	23
Cosmic Microwave Background	12	Standard model	22
Diffusion	12	Universe	22
Equation Of State	12	Models	21
Exact Solutions	12	Nuclei	21
Inflation	12	System	21
Neutrino Oscillations	12	Density	20

(truncated)

generally have more references than typical research articles because they often serve as surrogates for earlier literature, especially in journals that discourage extensive bibliographies³². There is a subtotal of 84847 references in the 3976 articles of *Pramana* with 21.34 references per article.

The data presented in Table 7 which gives the types-of-articles-wise distribution of references and their

descriptive statistics, reveals the above stated phenomena that review articles have an average of 104.4 references and the average of rest of the articles is 21.12. Box graph in Figure 5 depicts the variation in number of references in different types of articles.

Conclusions

When the productivity in terms of the number of articles being published in *Pramana* is concerned, the quantity is

Table 7 — Pattern of number of references in different types of articles published in *Pramana* during 1982-2006

Articles with no. of references	Biographical-Item	Correction	Editorial	Editorial-Material	Letter	Meeting-Abstract	Note	Reprint	Research Article	Review
1-10	1	32	2	5	29	10	46	0	752	0
11-20	0	0	0	0	22	0	37	1	1395	1
21-30	0	0	0	5	3	0	11	0	804	1
31-40	0	0	0	1	0	0	1	0	361	4
41-50	0	0	0	0	0	0	1	0	147	2
51-60	0	0	0	0	0	0	1	0	71	2
61-70	0	0	0	0	0	0	0	0	42	2
71-80	0	0	0	0	0	0	0	0	26	3
81-90	0	0	0	0	0	0	0	0	14	4
91-100	0	0	0	0	0	0	0	0	9	1
> 100 references	0	0	0	0	0	0	0	0	21	14
Articles without references	0	0	6	57	0	6	1	0	22	0
Total No. of Articles	1	32	2	11	54	10	97	1	3642	34
Total No. of References	4	45	3	183	552	47	1242	17	79203	3551
Average No. of References	4	1.41	1.5	16.64	10.22	4.7	12.8	17	21.75	104.4
Mode	NA*	1	NA	4	11	4	9	NA	12	NA
Median	4	1	1.5	21	10	4	11	17	18	85
SD	NA	1.16	0.71	11.37	6.32	2.16	8.14	NA	16.6	73.66

(*NA = Not available)

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.

The collaboration rate of the articles published is found as 0.70. The present trend of more institutional collaborative papers is found in case of *Pramana* articles. As the journal is of Indian origin, institutes from India are on the top of the list of contributed institutes. University of Delhi, Delhi tops the list followed by Bhabha Atomic Research Centre, Mumbai; Physical Research Laboratory, Ahmedabad; Institute of Physics, Bhubaneswar; Indian Institute of Science, Bangalore; Tata Institute of Fundamental Research, Mumbai etc. The articles originated from India makes three fourth of total articles studied. The number of articles written in collaboration with authors from countries other than the host country of the journal (India) has been increasing in the recent past. Cosmology; supersymmetry; chaos;

quantum chromodynamics; phase transition; and Quark-Gluon plasma are the most important physics micro-fields in which highest number of articles has been published. When the references in articles published, the average number of references per article is found as 21.85. When the references in review articles and rest of the articles are considered separately, the average is found as 104.4 and 21.12 respectively.

Pramana has been successful in terms of the increasing level of its quality. They may focus on inviting more review articles and the quality of them, so that the Impact factor of the journal may further increase. Citation analysis of the articles published in the journal may be compared with other popular journals in physical sciences. The contributed physicists can also make a note of the areas in which maximum research has been done and they can have an idea of where the research is lacking.

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