Scientometric Analysis of Astronomy and AstrophysicsResearch in India and China : A Comparative Study

**Arpit Sharma, Gurtej Singh Randhawa, Aditya Pandey**

**ABSTRACT**

The main purpose for the study of Astronomy and Astrophysics research is to examine the productive help of a particular country’s journals or research leading to the country’s development in that respective field. The assessed data has been taken from scimagojr database from year 2017-2008 i.e. of last 10 years. These research papers mainly contain the research/journals of countries like INDIA and CHINA. It particularly shows the countries field of interest in case of research/journals. This research paper will also tell about citations, citations per document etc of the documents/journals produced by that country. It mainly contains the data of number journals/documents harvested by INDIA and CHNA in that period of time including the growth, recession in the journal/document production. This research paper will also act as a medium of comparison between the two countries. This research paper will also include the applications of the researches done by an INDIA and CHINA in that particular field.

***Keywords:*** Astronomy and Astrophysics, India, China, scimagojr, scientometric, Research paper

* **INTRODUCTION**

For the identification and assessment of the potency and deficiency of scientific achievements of a country, the evaluation based on research papers and citations is one of the well known techniques that are being used now days. As a matter of fact that most of us know regarding the country’s development through research productivity is that , it depends on the production of research/journals, citations etc. by that particular country. The scientometric study that indicates the publication profile of a research institution, individual countries etc. are very closely related to a county’s development. Basically, scientomertic studies are generally intended to compare, identify and evaluate the output of scientific and research productivity. Through scientometric studies we are able to look closer to the country’s progress over the past years or decades in various field of research. Scientomeric studies help us to identify and understand the output of the researches done over the past few years. Scientometric studies are mainly aimed to access the impact or growth of various subjects/areas by that country that can be further accessed by its citations, citation per document etc. It also shows the deficiency in that countries research i.e. the decrement of research study in that particular subject. The bibliographic studies also play a vital role in production of a research paper, as it makes a research paper look attractive and interesting.

The main goal of scientometric and bibliographic study is to assess the scientific efficiency and impact of several areas, countries, institutions etc. This can be done by analyzing end number of indicators like h-index, g-index, and i10 and so on. Accurate assessment and judgment play a vital role in decision and comparison making while studying the growth of a country in terms of scientific information. In the recent years many bibliometric studies have been carried out to assess the productivity of research of various countries. Wang, Fu and Ho analyzed the scientific productivity of National Taiwan University and Perking University in a period of nine years i.e.:(2000-2009)and compared it using scientometric indicators and showed the publication outputs, publication patterns and inter-institutional collaborations of the two universities. Meena and Nagarajan assessed the Indian malaria research publication using several bibliometric indicators during 1974-2013. The study and the output described the growth pattern of the country, its collaboration with other countries in different sub-fields.

* **OBJECTIVES**

The objectives of the study are as follows:

1. To study the growth of astronomical research publication of India and China during the year 2009-2017.
2. To examine the sub-discipline coverage of Astronomical and Astrophysics research.
3. To study the citations per document, citable documents, h-index etc of the two countries.

* DATA SOURCE ANDMETHODOLOGY:-

The data has been collected from the website scimajojr.com which includes the number of citable documents, citations, H-index, citations per document etc from the year 2008-2017 for India and China.

* **CHINA’S ASTROPHYSICS AND ASTRONOMY RESEARCH**

China being on the verge to be called as a developed country has been contributing at a larger extent than India in the field of astronomy and astrophysics. According to our research data China is also somewhat variation in the publication of documents/journals in astrophysics and astronomy research. From year 2009 to 2017, China on an average has been holding 6thposition in the number of publication per year in astrophysics and astronomy research.

* **VARIATION IN THE PUBLICATION OF CHINA’S JOURNALS(2009-2017)**

A great variation can be seen in the publication of astronomy and astrophysics journals from year 2009 to year 2017. As we look forward to the table give below.

**CHINA’SPUBLICATIONS (2009-2017)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **YEAR** | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
| **PUBLICATIONS** | 1334 | 1276 | 1281 | 1658 | 1919 | 1838 | 1967 | 2058 | 1681 |

Both increment and decrement can be seen in the number of journals published. Like in year 2009, publications were 1334 but decrement was seen in year 2010 which further changed to increment to 2012 with later sudden decrement and then again an increment. If a graph was to be plotted it would had been seen something like this,

Same as earlier COMPOUND ANNUAL GROWTH RATE (CAGR) can be calculated by using the same formula :-

i.e:

CAGR= (Ending value/beginning value) ^((1/n)-1)-1

And is used to calculate the growth rate over the observed years in the research publications.

|  |  |  |
| --- | --- | --- |
| **YEAR** | **PUBLICATIONS** | **CAGR** |
| 2009 | 1334 | 0.00 |
| 2010 | 1276 | -4.35 |
| 2011 | 1281 | 0.39 |
| 2012 | 1658 | 29.43 |
| 2013 | 1919 | 15.74 |
| 2014 | 1838 | -4.22 |
| 2015 | 1967 | 7.02 |
| 2016 | 2058 | 4.63 |
| 2017 | 1681 | -18.32 |
| **TOTAL** | 27012 | 30.29 |

1. As observed from the above table, the total publications of CHINA for the years 20(09-17) is 27012 and the total compound annual growth rate is 30.29. The data gives us an idea of the research on astronomy and astrophysics by the particular country.
2. As depicted from the above data the growth of publication in CHINA over the observed period of time is non linear. Same for the publications the data is fluctuating at a non uniform rate.

* **INDIA’S ASTRONOMY AND ASTROPHYSICS RESEARCH PROGRESS**

India being a developing country has successfully made itself to be in the some of the countries which are contributing towards the research in astronomy and astrophysics. From the recent years, the variation in the publication of journals in the research field of astrophysics and astronomy can be seen and is countable. At present India holds nearly 14th position in the countries who are presently publishing astronomy and astrophysics documents/journals.

* **VARIATION IN THE PUBLICATION OF INDIA’S JOURNALS(2009-2017)**

The variation in the publication of astronomy and astrophysics journals has mainly led to the increment in the publication. As we look forward to the table give below.

**INDIA’S PUBLICATIONS (2009-2017)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| YEAR | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
| PUBLICATIONS | 524 | 570 | 577 | 669 | 687 | 810 | 849 | 855 | 705 |

There has been only increment from year 2009 i.e. number of publications=524 to the year 2016 i.e. number of publications=855, which can be further seen as a progress. There is just a slight decrement in the year 2017 i.e. number of journals published=70, but overall there is growth in the number of documents published over the years.

From here the concept of COMPOUND ANNUAL GROWTH RATE (CAGR) also arises i.e.

CAGR= (Ending value/beginning value) ^ ((1/n)-1)-1;

And is used to calculate the growth rate over the years in the research publications.

|  |  |  |
| --- | --- | --- |
| YEAR | PUBLICATIONS | CAGR (%) |
| 2009 | 524 | 0.00 |
| 2010 | 570 | 8.78 |
| 2011 | 577 | 1.23 |
| 2012 | 669 | 15.94 |
| 2013 | 687 | 2.69 |
| 2014 | 810 | 17.90 |
| 2015 | 849 | 4.81 |
| 2016 | 855 | 0.71 |
| 2017 | 705 | -17.54 |
| **TOTAL** | 6246 | 34.52 |

1. Here, as depicted from the above data the total publications of INDIA for the observed period of time is 6246. And the total compound annual growth rate is 34.52 . The data displayed above gives us the information that there is a slight difference between the data of CHINA and INDIA.
2. The growth rate of INDIA is not much different from CHINA. The growth rate of INDIA is also non uniform.

* **SUBJECT WISE RESEARCH COVERAGE BY CHINA**

At present, China has been concentrating in the field of **“EARTH AND PLANETARY SCIENCES”** and also in the field of “**COSMOLOGY”.** China’s recent articles can be seen in the top journals on scimagojr. Some of the articles mainly related to cosmology field are “Hot Accretion Flows around Black Holes”; “Accretion onto Pre-Main-Sequence Stars”; “Observing Interstellar Intergalactic Magnetic Fields”. Some articles like “Hydro geomorphic Ecosystem Responses to Natural and Anthropogenic Changes in the Loess Plateau of China”; “Sun, Ocean, Nuclear Bombs and Fossil Fuels: Radiocarbon variations and implications for High- Resolution Dating”; “Global Monsoon Dynamics and Climate Change” were mainly related to earth and planetary sciences.

* **SUBJECT WISE RESEARCH COVERAGE BY INDIA:-**

India’s most of the research can be seen in the “PARTICLES” field and in “NUCLEAR” field. Most of the contribution in the astrology and astrophysics research has been seen to come through this way. Somewhat contribution can be seen from field of Meteorology, Atmospheric sciences; physics multidisciplinary and geosciences multidisciplinary; instrumentation and many more.

* **APPLICATION OF THE CHINA’S RESEARCHES DONE IN ASTRONOMY AND ASTROPHYSICS**

China being nearly called as a developed country is taking a great advantage of astronomy and astrophysics researches. Not only in weather broadcasts, satellite imaging, nuclear Energy generation, satellite manufacturing, spacesuit manufacturing but also leading the world by using new technology, some of which even USA don’t have.

* **APPLICATION OF THE INDIA’S RESEARCHES DONE ASTRONOMY AND ASTROPHYSICS**

There has been a great advantage of the researches done by the researchers in astrology and astrophysics. Weather broadcasts, satellite imaging, nuclear power generation, spacesuits manufacturing etc. Not only have these articles contributed to the progress but also scientometric studies has led to the awareness of the need ,impact and output of the documents published till now in astronomy and astrophysics.

* **CONCLUSION:-**

This study reveals the progress done by India and China in the field of astronomy and astrophysics during the time period of 2009-2017.It has been observed that among the whole world India ranks 13th in the field of Astronomy and Astrophysics whereas China ranks 9th in the same category. The research progress for India is observed to have somewhat steady growth being maximum in the year 2016 and least in the year 2009.Similarly in case of China several fluctuations have been observed with maximum performance in the year 2016 and minimum being in the year 2010 and 2011.Therefore it can be said after above analysis that as compared to India ,China has been through much swift development in the field of astronomy and astrophysics and particularly in “Earth and Planetary Science” and in “Cosmology”. If we talk about India individually, it has also developed significantly in the field of Astronomy and Astrophysics and particularly in “Particle” field and in “Nuclear” field.

* **REFERENCES:-**
* <https://www.scimagojr.com/countryrank.php?area=3100&category=3103>
* <https://www.scimagojr.com/journalrank.php?area=3100&category=3103>
* Jain A, Garg KC. Laser research in India: Scientometric study and model projections.*Scientometrics.* 1992; 23(3): 395–415p.
* Keshav et al. Frontiers in radio astronomy research in India (1999–2012): A scientometric study. *E-Library Science Research Journal.* 2015; 3(05): 1–10p.
* N. SEN, New links in cooperation between India and China. *Current Science,* 25 February, 82 (4)  
  (2002) 384.
* WANG. H. W., Complementary economic and technological cooperation between China and India.  
  *Beijing Review,* 7 March (2002) 10–11.