Collaboration in Astronomy Knowledge Production: a Case Study in ScienceDirect from 2000-2004

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Introduction

The nature of collaborative activity has changed to some extent from that between individual scientists to group mediated by organizations or national and international bodies, during the transition between 'little science' and big science' (Price, 1963).
After World War II, teamworks, or giant collaborations became extensive in some fields such as High Energy physics (HEP) (Beaver, 2001).
In this article the literature of astronomy in ScienceDirect during 2000-2004 will be studied to achieve the following objectives.

Objectives

To investigate the giant collaboration in the area of astronomy in ScienceDirect during 2000-2004. The Bradfor's law will be applied to find out the core collaborative papers in this study. The core (top) collaborative papers will be analyzed to identify the main collaborative authors and countries. The collaboration coefficient and International collaboration in astronomy in ScienceDirect database from 2000 to 2004 will be investigated to find out the development of the collaboration during the studied period in this discipline.

Research Questions

1. Does Bradford's law confirm collaborators distribution in this study?
2. What is the extent of collaboration in astronomy articles indexed in ScienceDirect database from 2000 to 2004?
3. What is the international collaboration extent in this study?
4. In which journals the core astronomy articles (giant collaborative articles) have been published from 2000 to 2004 in ScienceDriect database?
5. What are the main collaborative countries in this study?
6. Who were the major collaborative authors in this discipline during the studied period.

Data Gathering

ScienceDirect database was searched for astronomy articles limited to years 2000-2004. We found 419 articles. All the 419 articles were downloaded on our pc in a short time (i.e. December, 2004). Following tags including Author(s), Journal(s), Affiliation(s), and publication dates were selected and converted to a database in Excel Spreadsheet for counting, ranking and analyzing.

Methodology

The Bradford's law applies to find out the giant collaborative articles in astronomy in ScienceDirect database from 2000 to 2004. The distribution of collaborators according to different periods of time will also be calculated. Collaboration Coefficient will be calculated and The number of authors per paper will be compared with the Collaboration Coefficient to find out the growth of collaboration in this area for this study. Finally, the International collaboration will be calculated to identify Iran's most important collaborating countries in this study.

Analysis of the Data

2761 co-author (collaborator) occurrences happened in the 419 astronomy articles during 2000-2004, which indicates a collaboration mean of 6.6 authors per paper. All 419 articles were published with 37 countries. Bradford's law was confirmed in this study and revealed the top 10 astronomy giant papers in ScienceDirect during 2000-2004. The Giant collaborative papers were published in 3 journals: Astroparticle Physics (7 articles), Nuclear Instruments and Methods (2 articles) and New Astronomy Review (one article). Of the top 10 Giant collaborative articles one was published in 2000, 2 articles in 2002, 3 and 4 articles in 2003 and 2004 respectively. In other words, one can say organizing large teams for giant collaboration is a phenomenon, which has mostly happened in the last years in this discipline.

The authors' occurrence distribution of different countries in the top 10 papers is also studied, out of 37 countries only 6 countries participated with 852 authors' occurrences (USA, Germany, China, France, Italy, Sweden respectively) and the rest of them i.e. 31 countries had only 92 (10%) authors' occurrences.

For further analysis the authors who have collaborated in providing the top ten papers were considered. These papers were written by 533 authors, of those one had participated in 7 of the top 10 papers in this study.

The Collaboration Coefficient was also calculated for each period separately to track the growth of CC, year by year. The analysis showed that the CC for astronomy papers has grown from 0.385 in 2000 to 0.534 in 2004. This clearly indicates the growing importance of Collaboration in astronomy research in ScienceDirect database from 2000-2004 (Figure 1).

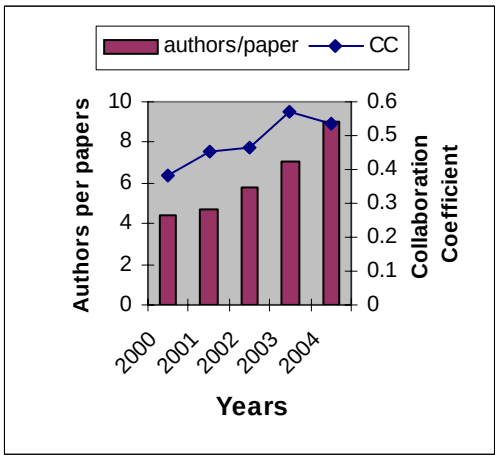

Figure 1. Collaboration Coefficient

This study found that about 77% of articles have been written by collaboration of 1-6 authors, while, 10% of articles have been provided with large or giant teams from 12 to 130 co-authors.

The distribution of International collaboration was also studied. Countries with at least 10 papers were selected for this step of the study. There were only 11 countries with minimum 10 to maximum 139 articles. It was observed that, USA with 139 (24%) collaborative occurrences ranked first among the 37countries. France, UK, Italy and Japan ranked second to fifth in this study.

The distribution of International collaboration with at least 10 collaborators was also considered. It was found that the multilateral collaboration dominated the single and bilateral collaboration in this study.

Discussion and Conclusions

The analysis of 419 astronomy papers in ScienceDirect during 2000-2004, indicated that all papers were published with 37 countries with a collaboration mean of 6.6 authors per paper. Similarly, Newman (2004) found that the number of papers per authors across three subject areas: biology, physics and mathematics is between 5-7.

Bradford's law was confirmed in this study and 10 core collaborative papers were identified. The co-authorship mean for these 10 papers was 94.4 per paper. The collaboration occurrence of the top 10 papers was 59-130 co-authors.

7 (70%) titles of the top ten papers have been published in the "Astroparticle physics Journal" and the rest of them i.e. 30% were published in two different journals (Nuclear Instruments and Methods in Physics A: Accelerators, Spectrometers, Detectors and Associated Equipment, and New Astronomy Reviews). This article found that team working mostly has happened in this discipline during last two years.

USA was identified as the main partner of Iran with 30% links from 2000-2004, in this study. Basu and Kumar (2000) similarly found USA as the main partner with India with 30% links from 1990-1994.

In this study the number of multi authored papers could be considerable since CC is equal to 0.494. To track the growth of CC, year by year, the collaboration coefficient was also calculated for each period. We found CC from 0.385 in 2000 to 0.534 in 2004 which indicated the growing collaboration in astronomy research in ScienceDirect database during the studied periods. Bharvi's et al. (2003) found that the scientometric output is dominated by single authored papers, while in the present study the multi authored papers are dominated

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