

Bibliometric Behavior of The Revista Mexicana de Astronomía y Astrofísica (1989–1995)

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Abstract. The bibliometric behavior of the RevMexAA (1989–1995) and its impact on the specialized scientific community are studied by means of the scientific content published in this Journal.

1. Introduction

The purpose of the present work is to show the results obtained from a statistical analysis of the Revista Mexicana de Astronomía y Astrofísica (RevMexAA), taking as reference the scientific content of the RevMexAA, edited by the Instituto de Astronomía of the Universidad Nacional Autónoma de México (IAUNAM).

Since the beginning of the century quantitative indicators based on statistical analysis of the variables characterizing the behavior of scientific production have been used for the purpose of evaluating the processes of generation, propagation and use of scientific literature as the most suitable transmission channel of scientific results, and a legitimate indicator for measuring its behavior.

Thus, the importance of evaluation of scientific results propagated by means of published information sources, particularly scientific journals, is constantly increasing. Their analysis and evaluation can provide, among other aspects, the concentration-dispersion behavior of articles per journal, which allows identification of the most productive ones, as well as their use, impact, visibility, and obsolescence. This knowledge allows us to characterize and to define their bibliographic behavior.

2. Source and Methodology

The sources used for this study were principally the CD-ROM databases of the Science Citation Index (1989 to 1996), as well as the Journal Citation Report (1994 microfiche version) edited by the Institute for Scientific Information (ISI), Philadelphia, USA; and the *Revista Mexicana de Astronomía y Astrofísica* itself (Vol. 18, 1989 to Vol. 31, 1995, including six special issues dedicated to proceedings of conferences).

The RevMexAA is financed by IAUNAM with partial support from the National Council for Science and Technology (CONACYT) of Mexico. Among the journal's many merits it should be mentioned that it is among CONACYT's list of journals of excellence as well as being included in the Science Citation Index as a source journal, which implies its diffusion through the Current Contents and the Journal Citation Reports; it is also included in international indexes and in specialized serials such as: Astronomy and Astrophysics Abstracts, Yellow Pages of the Astrophysical Journal, NASA Astrophysics Data Center Abstracts Service on the WWW, StarGuides Directory of Astronomy, Space Sciences and Related Organizations of the World, and in other indexes related to its topics as: Chemical Abstracts, Mathematical Reviews, Physics Briefs; in addition, it is included in such commercial directories as Ulrich's, International Periodical Directory, and Serial Directory.

The precedents of the RevMexAA go back to 1890 with the publication of the *Boletín del Observatorio Astronómico de Tacubaya* which from 1952 continues as *Boletín del Observatorio de Tonantzintla y Tacubaya* (Torres-Peimbert, 1995). In 1974 it began to appear as *Revista Mexicana de Astronomía y Astrofísica*. Currently, the Revista has an international publishing committee and a team of subject specialists of recognized prestige who serve as anonymous referees of all articles.

The methodological considerations of this study are related mainly to the creation of two databases. The first contains information on Revista's articles from 1989 to 1995. The second database contains references to the number of times each article in the Revista was cited during the period studied in the first database.

3. Analysis of Results

3.1. Scientific Production of the RevMexAA

Cetto (1997) identifies 15000 physicists and astronomers in Latin America (about 500 of them astronomers, M. Peimbert, priv. comm.) working at universities, institutions and observatories carrying out research and teaching activities, belonging to national societies, associations and colleges of such countries as Brazil, Mexico, Argentina and Chile among others.

The RevMexAA represents for these Latin American astronomers the main formal channel for publishing their research. This can be verified with the data presented later about the country and institutional affiliation of authors whose articles appear in the Revista.

On the other hand, the academic system of incentives put into effect recently in the majority of Latin American countries has encouraged and favored

the publication of results outside the region, mainly in North American and European journals.

This situation means that the RevMexAA is the region's main communication channel. The Revista's articles are of topmost quality, equal to those of other specialized journals in these topics. The information published in it reaches the highest level of dissemination possible in the field of astronomy and astrophysics. There are sufficient reasons for inquiring into the bibliometric characteristics of the Revista, and for providing answers to the following questions: who publishes in it, what are typical forms of collaboration among authors, what are the author's country and institutional affiliations, on what topics do they publish, in which years were more works published, as well as other questions concerning the impact or interest its articles produce in the scientific community: From which institutions and countries are the authors who cite the Revista? In what type of publications are there the greatest number of references to the Revista? What specific publications most frequently cite the Revista?

The results of the analysis of the RevMexAA for 1989–1995 contain 871 documents of which 459 correspond to meetings and abstracts of meetings published in the special issues of the Revista, and 412 correspond to scientific refereed papers. A study with a separate analysis of these types of documents can be consulted in Torres-Peimbert (1995). These documents were written by 2241 authors which gives a mean value of 2.57 authors per document.

Thus, for the purpose of the present work, and given the importance of the type of documents found in the Revista, it was decided to use this set of refereed documents published during the referenced period. 33% of articles were written by two authors. 25% correspond to articles written by one author and 22% written by three authors. The remaining articles were written by more than three authors, with one document having 31 authors. The data indicate a tendency of the Revista's authors to publish their works collectively mainly in groups of two or three.

Of the 871 principal authors in the sample, 94% are distributed among ten countries. Of these, five are Latin American, most notably Brazil, Mexico, and Argentina with 25%, 22%, and 17%, respectively. An interesting point to note is the presence of authors from U.S. institutions, comprising 12%.

As can be seen in Figs. 1 and 2, the main author's country of institutional affiliation is almost identical to that of all authors.

The article distribution by authors' institution confirms the IAUNAM's presence as the most frequent, with 36%, followed by Universidad de São Paulo and the Instituto Argentino de Radioastronomía with 21% and 9%, respectively. We wish to point out that, notwithstanding the fact that some of the Latin American countries, such as Brazil and Argentina are represented in the sample with two or more institutions and that Mexico also has two, the IAUNAM carries the bulk of the weight, taking into account both its central headquarters in México City and its branches in Ensenada, B.C. and Morelia, Mich. More detailed information about these variables can be found in Figs. 3 and 7.

The articles published by the Revista during the period analyzed show a varied and wide coverage of topics. Thus to topically analyze their frequencies, it was decided to group them in eight large categories, according to the Thesaurus

of Key Words of Astronomy & Astrophysics (A&A 316, A15–A17, 1996). This thematical grouping has permitted us to identify 47% of articles as related to stellar topics, due to the large variety of articles dedicated to chemistry and evolution of stars, supernovae, white dwarfs, binary stars and other topics. A smaller proportion of 15% and 11% respectively correspond to studies of galaxies, and physical data and processes. This is due to the fact that categories include everything related to the physical-chemical processes occurring in the formation and development of stars, as well as stellar systems and galaxies. Other thematic categories were identified in lesser proportions, as shown in Fig. 5.

An analysis of the publication dates of the *Revista* indicates that 41% of the articles were published in 1990. This is due to the fact that in that year a regular issue with articles was published and another special issue, particularly voluminous containing papers presented at the VI Regional Latin American Meeting of the IAU, held in Gramado, Brazil in 1989, was also published. 26% of the articles were published in 1993, when two special issues were dedicated to the VII Regional Latin American Meeting of the IAU in Viña del Mar, Chile in 1992, and the IV México-Texas Conference of Astrophysics, which took place in 1993 in Austin, Texas (Fig. 6).

3.2. Impact of the RevMexAA

If we consider the above in the context of our region's regular practice of recognizing more highly those authors publishing in foreign journals, we would not be far from the truth in stating that the practice of citing foreign journals of high renown instead of national ones, is sometimes taken into account when determining the assumed quality of published works. This not only jeopardizes the permanence and regularity of some journals in relation to others, but it also suggests the works published there do not have the impact and visibility they would receive otherwise.

Despite this apparent geographic determinism, the RevMexAA has been able to close the gap which, at times, separates journals from peripheral countries and those published in so-called central countries and which enjoy the recognition, impact and visibility of the international scientific community. It is only fair to point out that the regional policies of academic recognition or the prevailing system of dissemination of scientific knowledge such as the Science Citation Index, cannot always be blamed for this situation. Much depends on the internal policies adopted by the journal itself, a fact proven not only by the RevMexAA, but also by other journals publishing in disciplines such as physics, mathematics, and medicine.

The Journal Citation Report (1994 edition) ranks the RevMexAA according to its impact factor (0.508), in place number 25 among a total of 34 source journals processed by ISI, in the area of Astronomy and Astrophysics. However this position could be improved by separating out annual reviews and proceedings from regular journal issues together in the category of scientific journals; this consideration would place the *Revista* at number 21, and its impact factor would then approach the mean value of all the journals of its type, calculated at 1.400.

Gibbs (1995) concluded that the impact of the *Revista* should have been less than its calculated value. Nevertheless, Torres-Peimbert & Rodríguez (1996)

refuted this conclusion, showing that Gibbs used an isolated analysis of only two years' duration. On the contrary, they showed that by taking a ten-year sample (1985–1994), the impact factor was 0.55. This is sufficient reason to consider *RevMexAA* one of the best in its field and leader in Latin America.

Among the institutions of all citing authors, regardless of whether they were the principal author or not, the *Revista's* impact ranking stimulated our interest in analyzing the number of times and journals in which its articles were cited. The Science Citation Index uncovered 1001 citations between 1989 and 1996, referring to the 871 texts published from 1989 to 1995. The IAUNAM held first place with 40% of the total references to the *Revista*. It was followed by the Departamento de Astronomía of the Universidad de Chile, and the Instituto de Astrofísica de Andalucía with 12% and 9% respectively. According to the values shown in the Fig. 8 other institutions can also be identified although with smaller presence, such as the Universidad de São Paulo, Harvard Smithsonian Center for Astrophysics, and the MPE Munich, among others.

A superficial analysis of the values shown in Fig. 8 could lead to the simple conclusion that the *Revista* is mainly cited by authors that publish in it; in other words, that there exists an index frame of self-citations which appear in the *Revista* itself. However, a detailed analysis of the principal country affiliation of the citing main authors shows that the greatest number of references citing the *Revista* originate in the United States (30%), in Mexico (21%), and in Germany (11%). As Fig. 4 shows, each of the first 10 citing countries (3 Latin America, 2 North American, and 5 European) contributed with more than 20 citations to the *Revista*, which represent 66% of all references during the period analyzed.

The aforementioned data are substantiated by the fact that the principal citing journals were the *Astrophysical Journal* with 25%, *Astronomy and Astrophysics* with 20% and the *RevMexAA* with 15%. Other journals with lesser proportions were: *Monthly Notices of the Royal Astronomical Society*, *Astronomy and Astrophysics Supplement Series* and *Astronomical Journal*. These are all of high international prestige and ranking according to the ISI impact factor.

The interaction among main citing authors, institutions, journals and citing countries, reveals the degree of academic collaboration among Mexican authors who frequently publish in and cite the *RevMexAA*. The fruits of this collaboration are published mainly in North American and European journals. The 1001 citations of articles published in the *RevMexAA* are distributed among 51 journals titles that, with a few exceptions such as *Nature* or *Science*, are mainly specialized in astronomy and astrophysics, with a smaller proportion in physics, both molecular and nuclear, as well as quantum chemistry. While it is true that 89% of the identified citing texts are journal articles, it should be pointed out that the remaining percentage was distributed among other types of texts such as reviews and letters.

The statistical tendencies of the citations were not only varied, diversified, and spread widely among the main specialized journals, institutions, and latitudes, but the number of citations also grew in time. This can be observed in the sustained increase in its impact factor, pointed out above, and is ratified by analysis of the citations by dates of publication of the publications in which they appear. According to Fig. 9, 20% of the citing publications were published

in 1996, and 58% were published in the last three years of the studied sample (1994–1996).

4. Final Considerations

The RevMexAA is a journal of excellent quality and is the principal journal in the field in Latin America. It is used by the ISI as a source journal for its science reference series. The RevMexAA is indexed in the main information systems, both in its speciality field and in other related specialities.

The study of its bibliometric characteristics provides results in two dimensions. The first refers to the quality of its scientific production and the second to the identification of its impact on the scientific community. Both types of conclusions contribute useful information for the decision making process with respect to scientific publishing policy.

2241 authors participated in writing the 871 texts published in RevMexAA during the period analyzed. This represents an average of 2.57 authors per text. These articles were cited 1001 times, which means that each text was cited an average of 1.14 times. Between 1985 and 1994 the journal's average impact factor was 0.55 which means that, theoretically, all of the articles published in RevMexAA are cited in other scientific articles.

The main citing source of the Revista is the *Astrophysical Journal*. The country of institutional affiliation of the greatest number of citing authors is the United States. This confirms that the impact of the Revista is not a result of self citation, but, on the contrary, its main citing authors publish in and are affiliated with US institutions. This is mainly due to the scientific collaboration between Mexicans and North Americans, Spaniards, Chileans, Germans and Argentinians.

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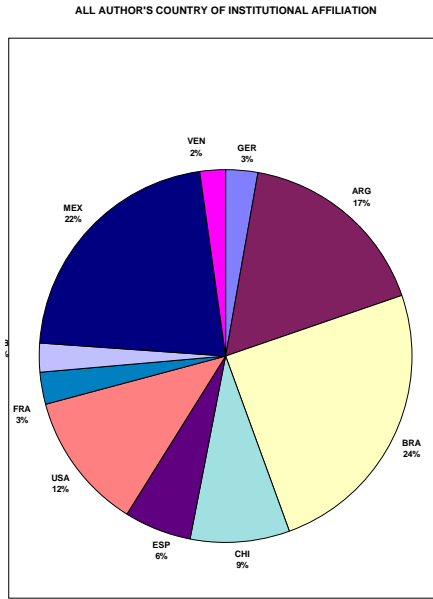


Fig. 1

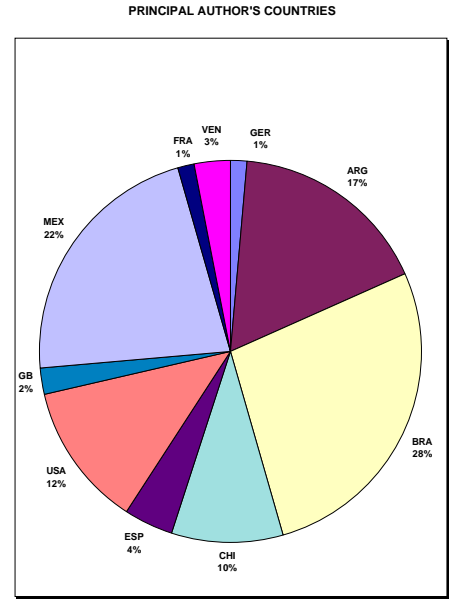


Fig. 2

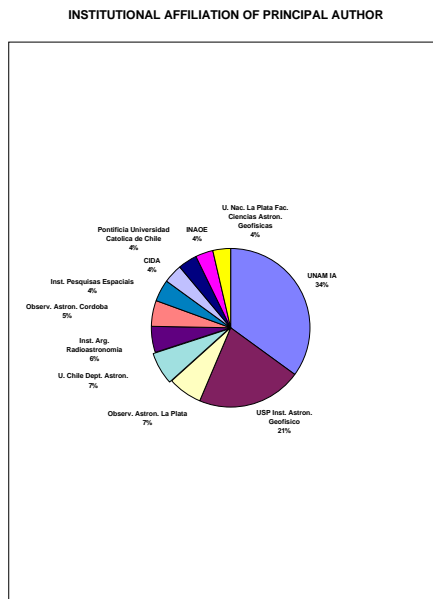


Fig. 3

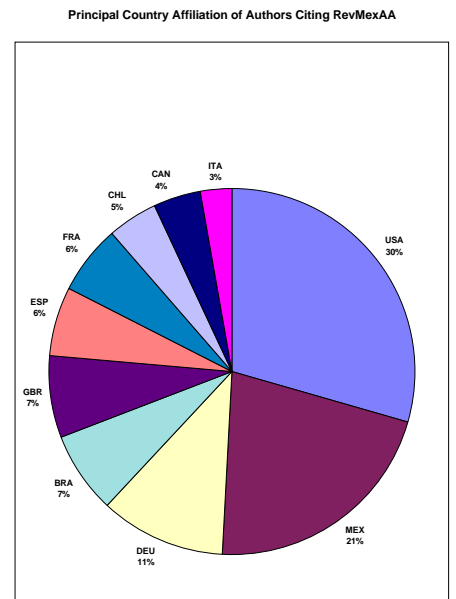


Fig. 4

THE PRINCIPAL KW OF THE ARTICLES PUBLISHED IN THE REVMEAXA (1989-1995)

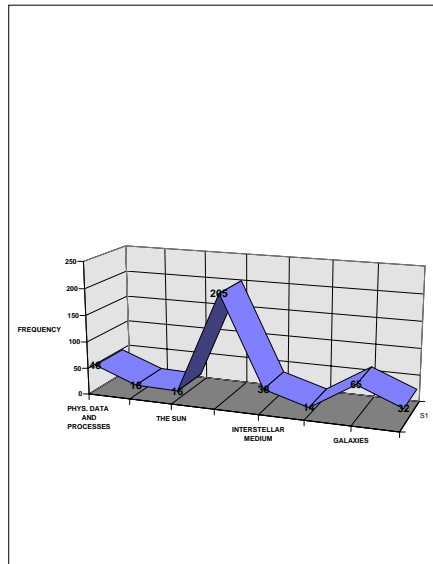


Fig. 5

NUMBER OF ARTICLES PER YEAR

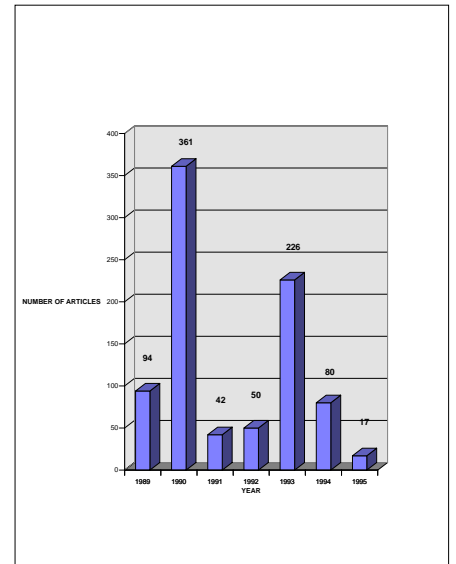


Fig. 6

PRINCIPAL INSTITUTIONS OF ALL AUTHORS

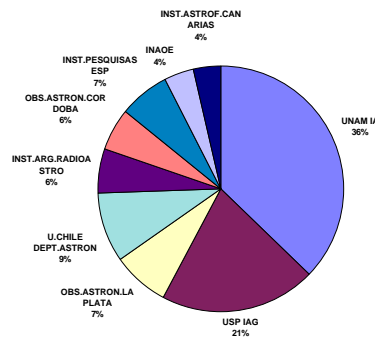


Fig. 7

Ten Most Frequently Occurring Institutional Affiliation of Authors Citing RevMexAA (1989-1995)

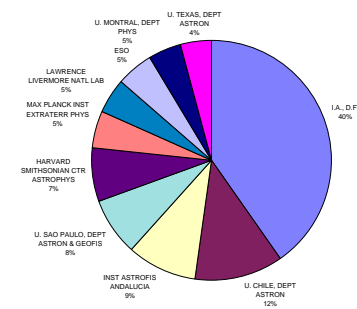


Fig. 8

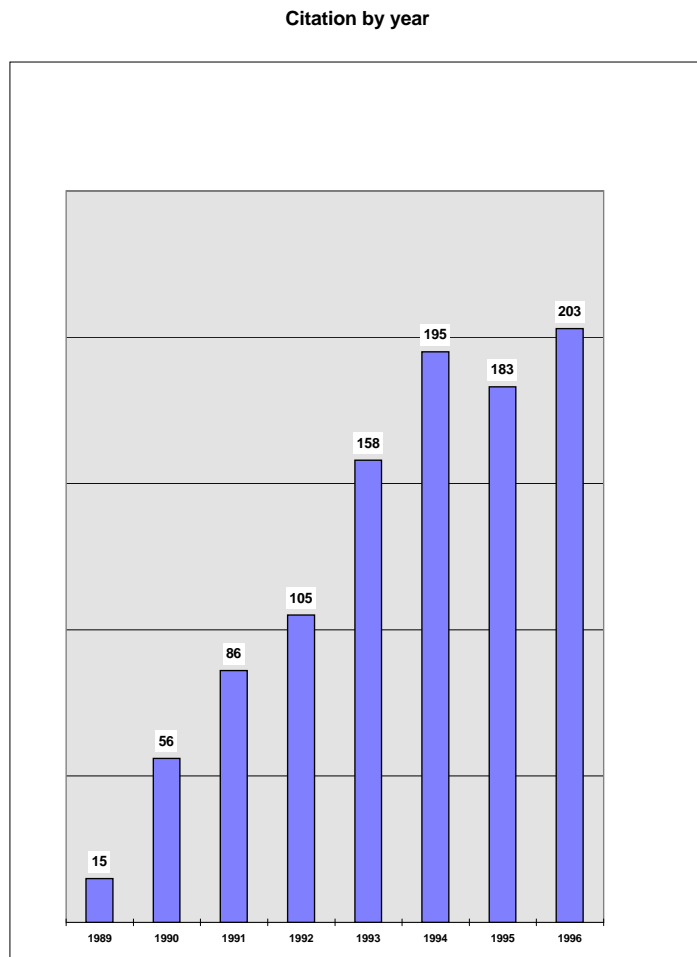


Fig. 9