

## Part 7. Astronomical publishing

# Publication Changes during the IAU History

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**Abstract.** During the 100 years of the International Astronomical Union, the worldwide astronomical publications have grown exponentially, converted almost entirely to English, and changed format from observatory publications to journals to online publications. Observatory publications, conference proceedings, and individual theses have nearly disappeared in usefulness for research.

**Keywords.** IAU membership, astronomical publications

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## 1. Growth

The membership of the IAU increased from 200 in 1919 to 12,664 at the end of 2017, or by a factor of 63. The increase (Fig. 1) was slow until about 1960 but linear after 1970 at a rate of 218 additional members per year. On the other hand, a journal like the *Astrophysical Journal* (ApJ) showed an accelerated growth since 1970 (Fig. 2). Between 1920 and 2010 the ApJ pages, corrected to the same page sizes, grew by a factor of 140, compared with the above growth by a factor 63 in IAU members. This could either mean that IAU members are publishing twice as many papers now as a century ago or, perhaps more likely, many papers are being published by young people who are not yet IAU members. In 1919 there were only 16 astronomical journals of which I am aware. They are listed in Table 1, arranged chronically by year of formation. The nine still being published are marked with asterisks.

At the present time there are ~140 astronomical journals being published, depending on how they are defined. That is a factor of ~10 increase in journals.

In 1969 five European journals stopped publication in order to direct their papers to the new *Astronomy & Astrophysics, A European Journal* (A&A). They were the *Annales d'Astrophysique* (1938), *Bull. Astronomique* (1884), *Bull. Astron. Institutes of the Netherlands* (1921), *Journal des Observateurs* (1915), and *Zeitschrift für Astrophysik* (1930). Similarly in China and Russia some journals were combined.

## 2. Languages

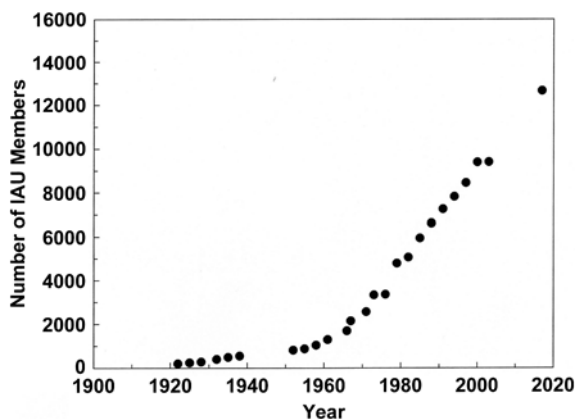
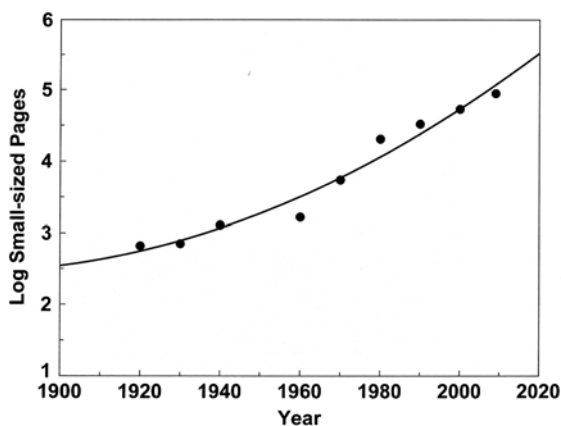
Of the 16 astronomical journals published in 1919, only 62% were in English; the remainder were in German and French. Now of the ~140 journals, 98% are in English. The remainder are in Russian and Chinese. But we know that Chinese does not have the vocabulary and grammatical versatility (different tenses, singular and plural) as does English and is therefore not as useful for science.

## 3. Publication Locations

Astronomers in the 20th century had the choices of publishing their papers in observatory publications, journals, monographs (books), conference proceedings, individual theses, or preprints. Abt (2009) explored the frequencies of references to those during 1952–2009. It turns out that observatory publications and in-house publications decreased

**Table 1.** Astronomical Publications at the Time of IAU formation. The nine journals still being published are marked with \*

Journal	Year	Country
<i>Memoirs of the RAS</i> (*)	1822	England
<i>Astronomische Nachrichten</i> (*)	1823	Germany
<i>Monthly Notices of the RAS</i> (*)	1827	England
<i>Astronomical Journal</i> (*)	1849	USA
<i>Vierteljahrsschriften der Astron. Gesellschaft</i>	1866	Germany
<i>The Observatory</i> (*)	1878	England
<i>American Ephemeris &amp; Nautical Almanac</i> (*)	1880	USA
<i>Bulletin Astronomique</i>	1884	France
<i>PASP</i> (*)	1889	USA
<i>Popular Astronomy</i>	1893	USA
<i>Sidereal Messenger</i>	1893	USA
<i>Astrophysical Journal</i> (*)	1895	USA
<i>Sirius</i>	1897	Germany
<i>Journal of the RAS of Canada</i> (*)	1907	Canada
<i>Journal des Observateurs</i>	1915	France
<i>Beobachtungs-Zirkulare der Astron. Nach.</i>	1919	Germany

**Figure 1.** Membership of the IAU as a function of time.**Figure 2.** Number of papers in the *Astrophysical Journal* as a function of time.

rapidly in usefulness (counted by citations to them) from 12 to 1%. That decrease is for several reasons: (1) for such publications the publishers fund the entire costs of publication and distribution, and the readers receive them free. That hardly seems fair. (2) Observatory publications have, at most, internal reviewing which may not be as thorough as anonymous external reviews. (3) Recently journals are available online while the observatory publications usually are not. Journals have become the primary location for research papers. Now 90% of citations to research papers are in journals. One reason is that most of them are now online and are available to researchers on their laptops, even when they are away from libraries. Another reason is that journals tend to be published quickly, unlike books and conference proceedings.

Monographs or books, surprisingly, have been decreasing in popularity for referenced sources from 7 to 4%. While they are very useful to review or learn a topic or field, they usually do not contain the data needed to prove the results. Also, they are slower to get published than journal papers and are usually not available online. Editors tell reviewers that authors should cite the first paper that demonstrated a result and the most recent or best demonstration.

Conference proceedings became popular reference sources after WWII when the numbers of conferences started to become very numerous, due to the convenience and speed of airline travel. Papers in them approached 10% of all references. However, authors realized that those papers gave results but not the data and documentation to prove them. Also, they are slow in becoming published compared to journal papers and are often not available online. They now account for only 2% of all citations.

It used to be a requirement that every Ph.D candidate had to write a thesis that usually was about 300 pages long and telling everything that the candidate had learned related to the topic of his/her thesis. However, other researchers do not have the time to read so much material to learn and evaluate the conclusions. Therefore references to theses went from nearly 2% of all references to less 0.5%. Instead, most universities now demand that the candidates have one or two concise papers accepted by major journals.

Parts of astronomy now are fast-moving fields in which papers are often quickly superseded so researchers want to know the conclusions and thinking of other scientists, i.e., they want to learn those before acceptance of other papers. That need was satisfied by preprints listed in the ApJ yellow pages (1980–1999) and then Cornell University's *Astro-ph* (since 1992). References to preprints are increasing from 0.5% in the 1950s to a current 2%. However researchers have to beware because many preprints are never accepted to publication. In fact, one editor of a chemistry journal looked up manuscripts that he had rejected and found that half of them were still listed as active preprints.

References listed as “private communications” have disappeared from a high of 2% because readers have no idea of the contents of those communications.

Reviews are slowly increasing as references to 1.5%. Reviews are important to read, but most references should be to the full papers that give the data and justifications for the conclusions.

#### 4. Technical Improvements

There were technical improvements made in recent decades. For instance, the paper stock used until recently was too grainy to allow high-quality halftones. There have been large changes in grain sizes of paper such that now all halftones can be included within the papers. Previously they were printed on glossy stock at the end of the issues because it was too expensive to cut the signatures and hand-insert them into the signatures. Also new paper stock is 22% thinner, with the same see-through, so issues became thinner.

Journals now have fairly uniform sizes of about  $20 \times 28$  cm, rather than the smaller sizes used in the past by the ApJ, PASP, and MNRAS, allowing more material for the same shelf space.

Colour prints used to be very expensive, causing page charges of about \$900 per page, even after the authors provided colour-separation negatives. Now they are virtually the same as black-and-white pictures.

We tried several formats prior to the online editions. One was videos (1992) that were mailed to subscribers abroad by airmail. We also started using CD-ROMS (1993) for large collections of data. The ApJ promised to transfer that material to later formats, namely online, when it became available.

The ADS (*Astrophysical Data System*) at *Smithsonian Astrophysical Observatory* at Harvard University has been a hugely useful resource for finding papers by individual authors. Now for any “astronomer” is spelled correctly one can find any of his/her papers, usually available with full texts and with citation counts from Reuters the Web of Science, providing that one’s library has a paid subscription.

Peter B. Boyce, Executive Director of the AAS, obtained a grant from the American National Science Foundation to program an online version of the ApJ. It appeared in 1996 as one of the first scientific publications printed online, in the same year as MNRAS. The online version of the AJ followed in 1998. By 2015 the printed version of the ApJ stopped, as did A&A in 2016 and MNRAS in 2013. There were extensive discussions about whether the printed version or online version predominated in accuracy, and the latter won on grounds that it could be corrected.

Will the next century see as many changes to astronomical publications? My imagination of future technical possibilities does not allow me, at least, to guess.

## References

Abt, H. 2009, *PASP*, 121, 544