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SOME STATISTICS REGARDING THE ASTROPHYSICAL JOURNAL AS PUBLISHED BETWEEN 1990 AND 2006, INCLUDING COMPARISONS WITH SISTER JOURNALS

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Abstract. Discussed here are some statistics pertaining to The Astrophysical Journal, with the information for the ApJ placed in context by drawing comparisons with the three other principal international journals in the field of astronomy, namely the Astronomical Journal, the Monthly Notices of the Royal Astronomical Society, and Astronomy & Astrophysics. The statistics deal with such matters as number of papers published per year in these journals, the characteristic number of pages per paper, and the characteristic number of authors per paper. The statistics show the current situation as well as trends during the period since 1990, with some lesser attention paid to the period since 1950. The characteristic page length pertaining for The Astrophysical Journal shows no evidence for a curtailment of length following the nominal 20-page limit; the lengths for both The Astrophysical Journal and the Astronomical Journal show no curtailment of length that could be attributed to the direct page charges required of authors in the AAS journals. The statistics are illustrated by figures that are largely self-explanatory, and so are accompanied with but little supporting text.

The development and growth of The Astrophysical Journal since its founding in 1895 have been described, at the time of the journal's Centennial, by Osterbrock (1995); in the same centennial issue Brashear (1995) described the emergence of astrophysics and the role played by the ApJ during the rise of this new science. Some statistical highlights of the ApJ during its

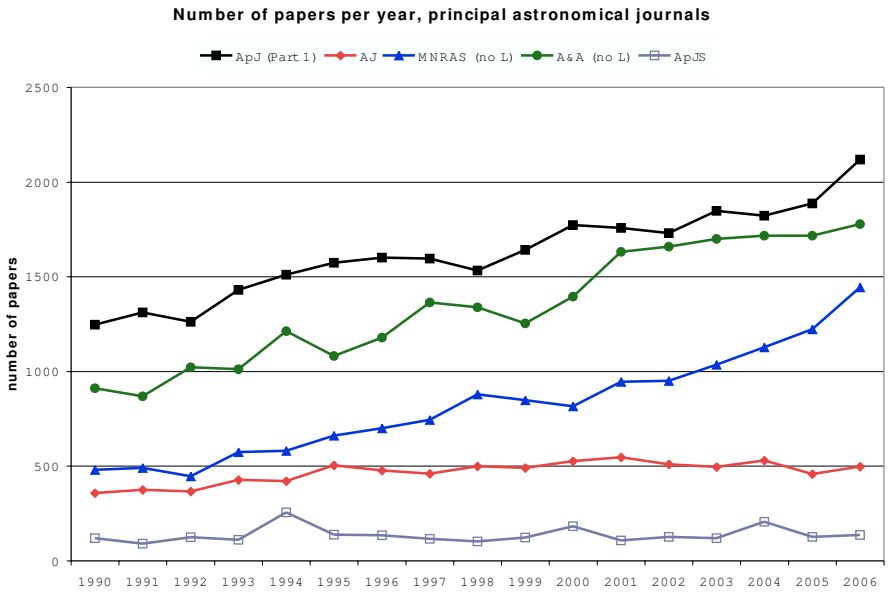

Figure 1. Number of papers published per year since 1990 in the main portions of the principal astronomical journals.

first hundred years have been presented by Abt (1995). Abt (1981, 2006, 2007a) and Trimble (1984) have placed the growth of the ApJ in a broader (and earlier) context than considered in this report, by examining trends in a large number of journals dedicated to astronomy and astrophysics, and by comparing these trends with those displayed in other exact-science fields, including mathematics, physics, and chemistry. Numerous articles that have appeared in the seven-volume series "Organizations and Strategies in Astronomy", edited by André Heck (2000-2006) and published in the Kluwer/Springer "Astrophysics and Space Science Library", are also relevant to the matters considered here.

To allow comparison with Part 1 of the The Astrophysical Journal, the Letters portion of Astronomy & Astrophysics are not tallied in Fig. 1, nor are the Letters (or the "Pink pages" for the period before 1993) of the Monthly Notices. The journals each show a steady increase in number of papers published over the period considered.

Three issues of Part 1 of the ApJ are published monthly, appearing on the 1^{st}, 10^{th}, and 20^{th} day of each month. Two issues comprise a single volume; thus 18 volumes of the ApJ are published per year. Typically a single issue of Part 1 amounts to some 700 pages. The Astronomical Journal is published monthly, with some 500 pages per issue; six issues comprise a volume, and there are two volumes per year. The MNRAS is published

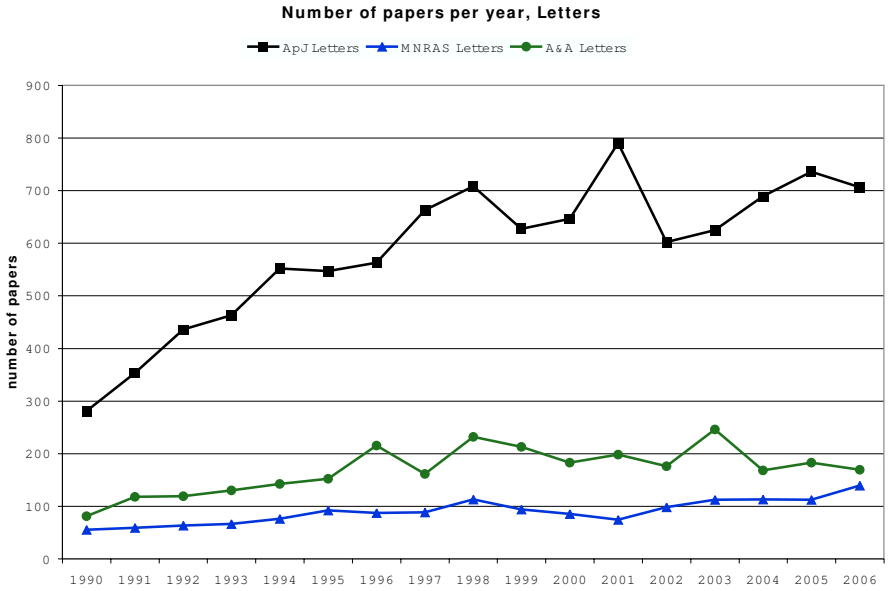

Figure 2. Number of papers published per year since 1990 in The Astrophysical Journal Letters and in the Letters portions of the Monthly Notices and of Astronomy & Astrophysics.

on the 1^{st}, 11^{th}, and 20^{th} day of each month, with single issues typically amounting to some 450 pages; four issues comprise a volume, and there are thus nine volumes per year. A&A is published four times each month, with single issues typically some 375 pages long; three issues comprise a volume, accounting for sixteen volumes per year. One issue of the ApJ Supplement Series is published each month, with the number of pages per issue varying widely - 400 pages per issue is a representative value; two issues of the Supplement Series comprise a volume.

The Astrophysical Journal Letters, Part 2 of the main journal, are published on the same schedule as Part 1, appearing on the 1^{st}, 10^{th}, and 20^{th} of each month, with typically some 60 pages per issue. Two issues comprise a single volume; Part 2 and Part 1 of the ApJ share the same volume number. The Astronomical Journal does not present a separate Letters section. The Monthly Notices Letters are now published as an on-line-only edition, with a month's articles comprising a single volume, volume-numbered as in the main journal of the MNRAS, and amounting typically to some 80 pages. Some 20 pages of Letters typically appear in a separate section of most issues of Astronomy & Astrophysics.

Fig. 2 shows that the number of Letters published in each of these journals more than doubled during the period 1990-2006. Some of the ir-

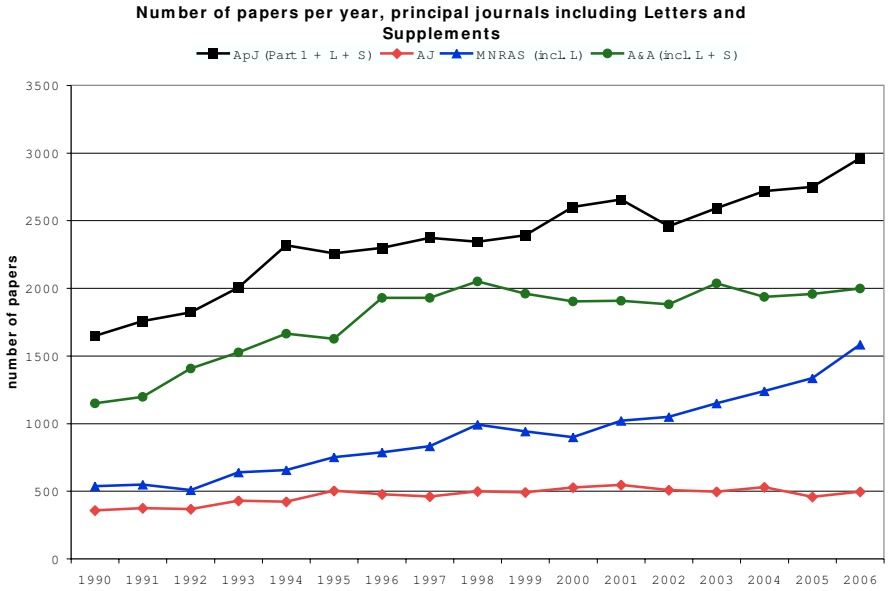

Figure 3. Total number of papers published per year since 1990 in the principal journals.

regularities in the distributions stem from the "Special Issues" published on occasion by ApJ Letters and by A&A Letters.

For The Astrophysical Journal, the total number of papers per year shown in Fig. 3 sums the papers in Part 1 (the main journal) and in Part 2, the ApJ Letters, as well as in the ApJ Supplement Series. The on-line-only Letters portion of the Monthly Notices is tallied with the main MNRAS journal. The Astronomy & Astrophysics data include the Letters, as well as the A&A Supplements for the period before the end of 2000; in January 2001, the A&A Supplements were merged with the main journal and thus were no longer published as a separate entity.

Does the growth of the number of papers simply reflect the growth of the number of astronomers? Plotted separately in Fig 4 are three different categories of membership of the American Astronomical Society. Most relevant for publication statistics are the classes "Full", "Junior" (mostly graduate students), and "Emeritus", because members of these classes are likely to be relatively active in publishing. The total membership indicated includes just the three categories of membership plotted, and thus does not include certain other categories, including "Associate", "Honorary", "Life", and "Corporate Affiliate"; these additional categories represent few individuals, or few who are actively publishing. (The data for the year 1997 were not found in the AAS Annual Reports, and thus were interpolated

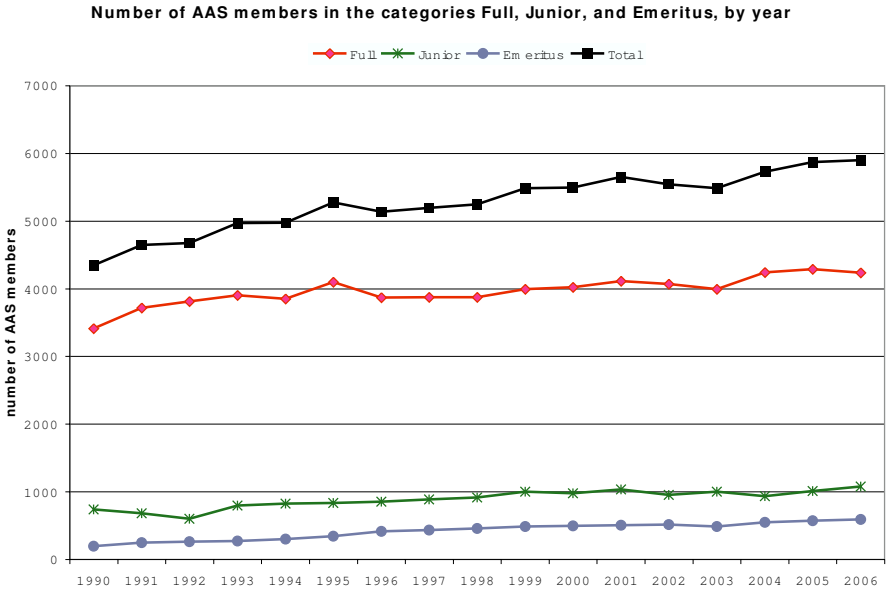

Figure 4. Number of members of the American Astronomical Society in the period 1990 to 2006.

here between the adjacent years.) The number of AAS members grew by about 25% during the period represented. This growth rate is less than that of the number of papers published in The Astrophysical Journal during the same period, which amounted to about 80%. Of course, many papers published in the ApJ are contributed by authors with foreign affiliations, and by others who are not members of the AAS. (For comparison: the total membership of the IAU was 9742, as of 3 July 2007.)

For comparison with the American Astronomical Society membership, Fig. 5 shows the percentage of papers published in Part 1 of the ApJ by the indicated national affiliation of the first author: "North America" includes Mexico, the USA, and Canada, the territory served by the AAS. "South America" includes countries south of Mexico; "Europe" includes all of the (ex-) Soviet Union, as well as Turkey; "China" includes Taiwan. Of course, most papers published in The Astrophysical Journal have multiple authors, and an international authorship is very common. Here, the affiliation for each paper was identified simply as that given for the first author; if multiple affiliations were given for the first author, the first of these was taken. (The relevant caveats for such a measure, given the peripatetic nature of an astronomer's life, will be evident.) The percentage of papers published in the ApJ by first authors resident in the AAS territory has been approximately constant since 1990, at about 69%. The percentage contributed

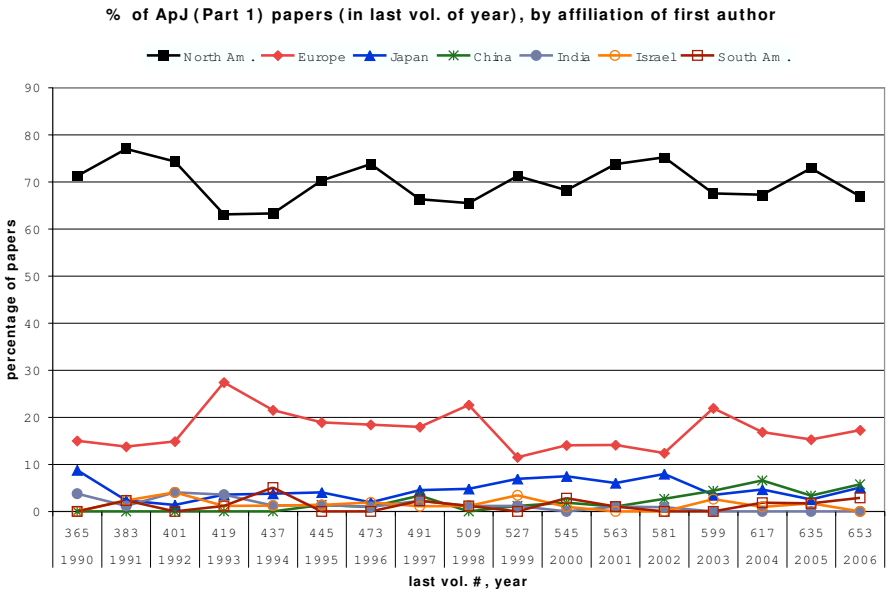

Figure 5. Percentage of papers published in Part 1 of the ApJ, in the last volume of each year, for the indicated national affiliation of the first author.

from European institutions has also remained approximately constant, at about 20%. Since about 2001, the percentage of manuscripts submitted by first authors from China has been increasing, and is now at about 6%. Not plotted are the contributions with first authors from Australia (1.2% over the period) or Korea (0.6%), or from all other countries (0.3%). Only data are entered for the last ApJ volume of each year (because the measure was not automated, and thus was rather laborious), but nevertheless, with 1638 papers represented, the statistics are probably reliable.

Fig. 1 shows that the total number of papers published in Part 1 of The Astrophysical Journal has grown steadily and strongly since 1990; Fig. 4 shows that the AAS membership has also grown steadily, but less rapidly than the growth of the number of ApJ papers. After adjusting the number of papers to include only those whose first author was affiliated with an institution in the territory (Mexico, USA, and Canada) from which the AAS draws its primary membership, the quotient showing the North American ApJ papers per society member per year is plotted in Fig. 6. The dashed line represents a linear fit to the data. This measure indicates a modest growth in the production of ApJ papers per AAS member.

In a separate study, Abt (2006, 2007a) determined the annual numbers of papers published by American authors in the major American journals in the fields of physics, astronomy, geophysics, mathematics, and chemistry.

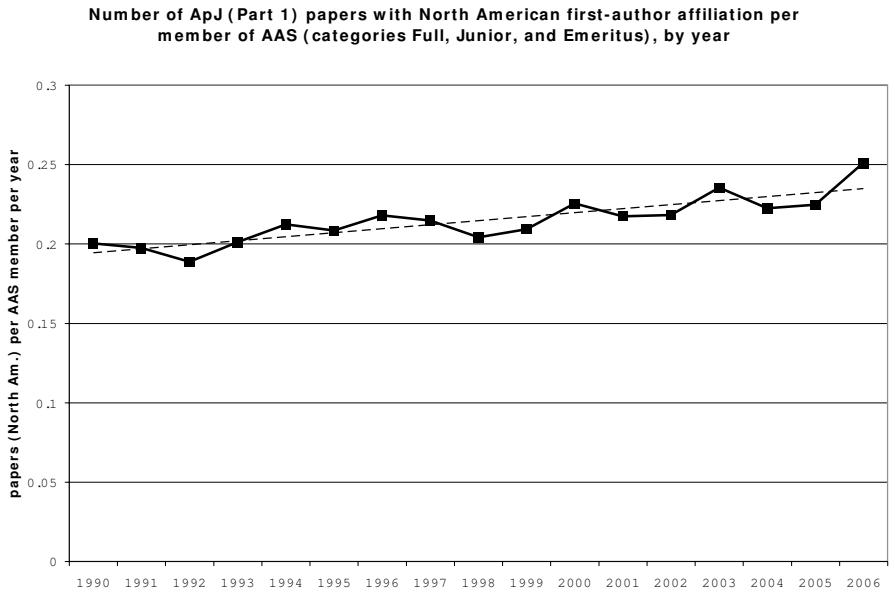

Figure 6. Number of papers published in Part 1 of The Astrophysical Journal by first authors with institutional affiliations in North America per member of the AAS, by year.

For astronomy, Abt combined the publication data for The Astrophysical Journal, the ApJ Supplement Series, the Astronomical Journal, Icarus, and the Publications of the Astronomical Society of the Pacific. The combined data considered by Abt led to the conclusion that the annual number of papers per AAS member published in these five journals has remained constant. But the increased productivity indicated above for the ApJ alone reflects the particularly strong increase in the number of papers published in that journal during the period under consideration.

Figs. 7 & 8 show that the introduction of these major new facilities excited surges in the number of papers published based on these instrumental breakthroughs. The Hubble Space Telescope was launched in 1990, but the main surge of papers followed the servicing mission of 1993. The Chandra X-Ray Observatory, launched in 1999, and the Spitzer Space Telescope, launched in 2003, also excited surges of papers. The ground-based Sloan Digital Sky Survey project and the Keck Telescopes came on line more gradually, but now figure strongly in the papers published in The Astrophysical Journal. Nevertheless, as Abt (2006, 2007a) has shown, and as the smooth behavior of the trend in the number of papers published per year in the ApJ shown in Fig. 3 confirms, the papers based on the new facilities represent a shift of attention, but do not produce jumps in the total number of papers published in the ApJ.

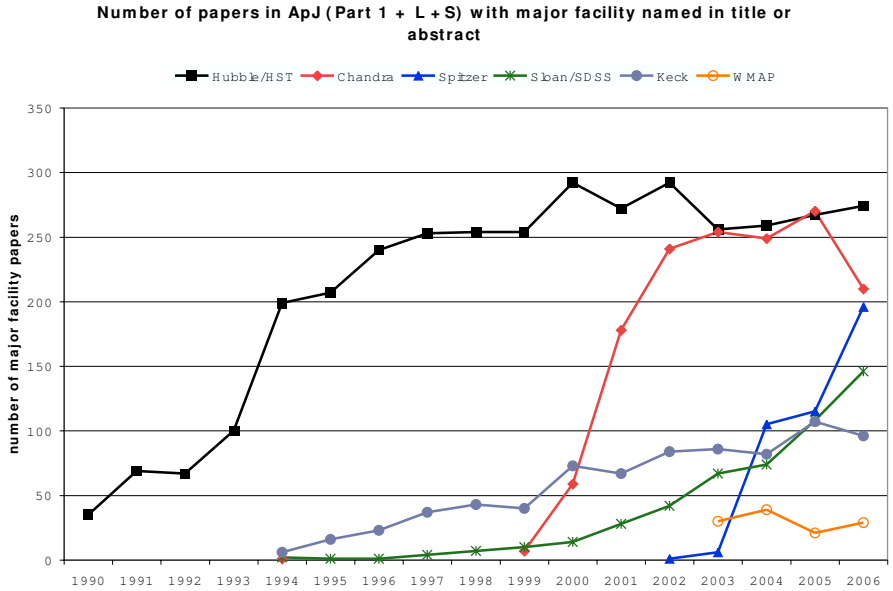

Figure 7. Number of papers published in The Astrophysical Journal (Part 1 as well as in ApJL and ApJS) that mention one of the indicated major facilities in the title or abstract.

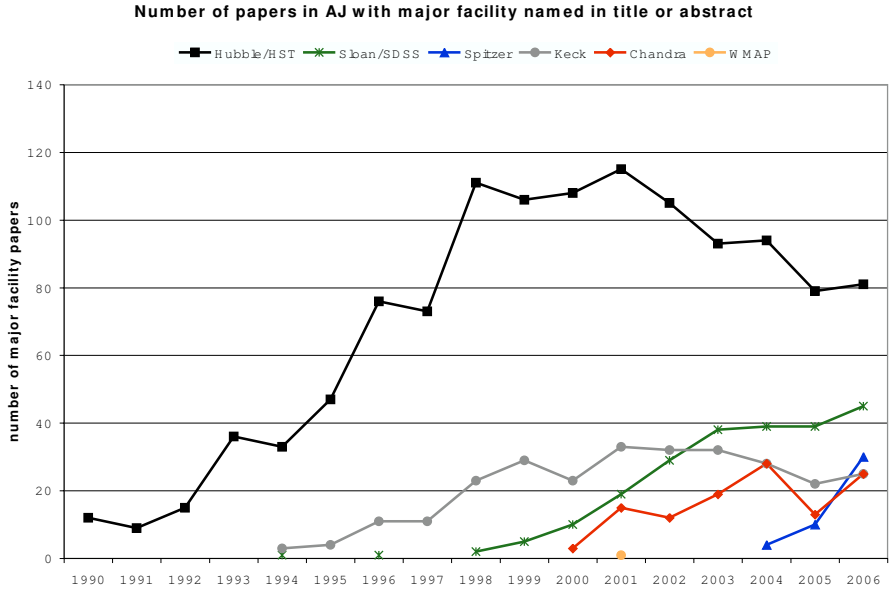

Figure 8. Number of papers published in the Astronomical Journal that mention one of the indicated major facilities in the title or abstract.

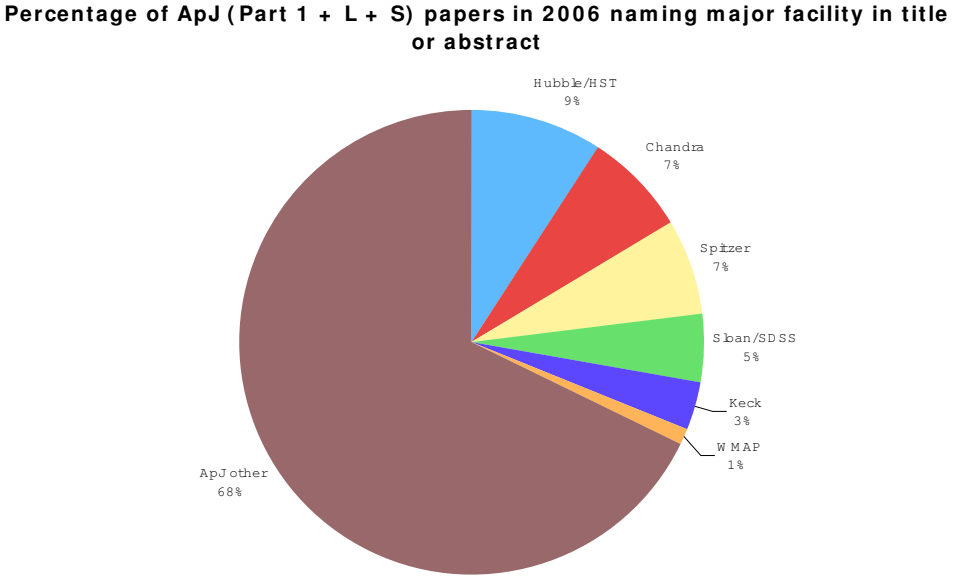

Figure 9. Percentage of papers published during 2006 in The Astrophysical Journal (Part 1, Letters, and Supplement Series) that mention the indicated observing major facilities in either title or abstract.

Although papers based on the new facilities appeared rather abruptly, and although the facilities named here were involved with some 40% of all Astronomical Journal papers in 2006, there are no corresponding jumps in the Fig. 3 plot showing the total papers published in the AJ per year, just as there are no such jumps in the similar plot for the ApJ.

Quite general discussions of the productivity and impacts of observational facilities, taking the publication statistics of some 18 journals into account, have been presented by Trimble, Zaich, & Bosler (2006) for the case of space-based facilities, by the same authors (Trimble et al. 2005) for the case of optical telescopes, and by Trimble & Zaich (2006) for the case of radio telescopes.

Fig. 9 Shows that about one quarter of the papers published in The Astrophysical Journal during 2006 made use of observations obtained with one of NASA's series of Great Observatories satellites. The Sloan Digital Sky Survey and observations obtained with the Keck Telescopes figure in about 8% of the papers published in the ApJ during 2006.

Fig. 9 shoes that more than 40% of the papers published in the Astronomical Journal in 2006 mention, in title or abstract, either the Hubble Space Telescope, the Chandra X-Ray Observatory, the Spitzer Space Telescope, the Sloan Digital Sky Survey, or the Keck Telescopes. Compared to

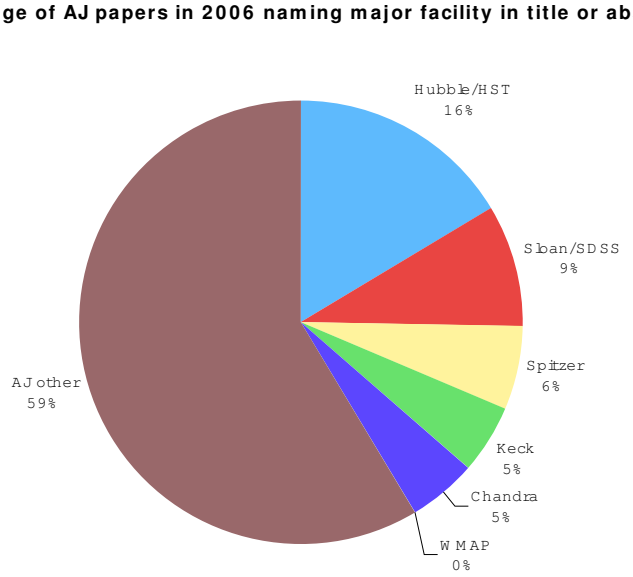

Figure 10. Percentage of papers published during 2006 in the Astronomical Journal that mention the indicated observing facilities in either title or abstract.

the situation at the ApJ, a higher percentage of AJ papers make use of observations from the HST and from the Keck Telescopes, and of the Sloan Digital Sky Survey; the ApJ papers make relatively larger use of Chandra and Spitzer data. The differences are not large. It is worth pointing out that there is no formal distinction between manuscripts deemed appropriate for the ApJ and for the AJ. The four journals considered in these notes welcome in principle submissions from all branches of astronomy and astrophysics.

Fig. 11 shows that the average length of papers published in the four principal journals has remained quite constant for the years shown; furthermore, the average page length, of 10 or 11 pages, is about the same for The Astrophysical Journal, the Astronomical Journal, the Monthly Notices of the Royal Astronomical Society, and Astronomy & Astrophysics. The slightly longer average length of an AJ paper plausibly reflects the fact that the AJ publishes relatively more papers with basic observational material, and thus with extensive images, than the other journals considered. (No correction has been made to account for the somewhat different number of words-per-page characteristic of the journals: it is difficult to account for differing word densities since large images and tables are important for all of the journals considered. Nor has a correction been introduced to account for differences in paper size.)

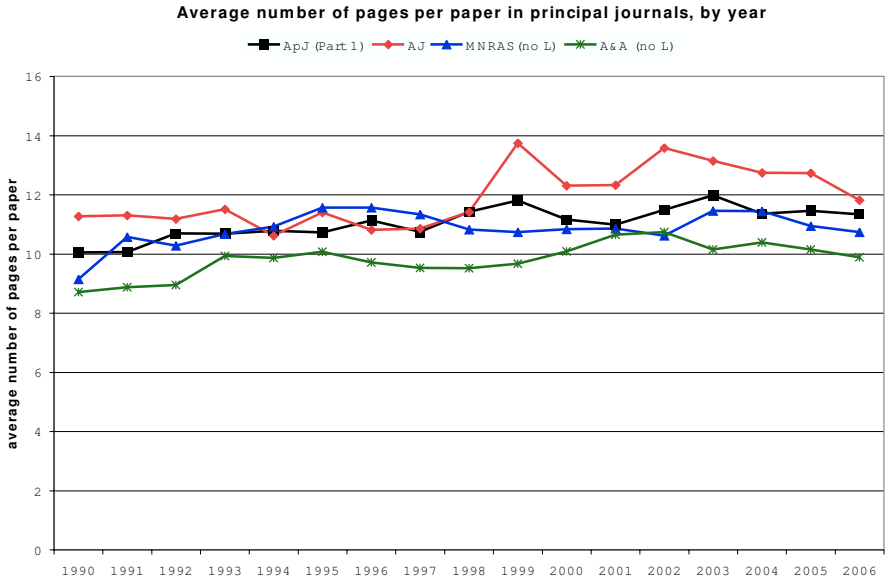

Figure 11. Average number of pages per paper, by year, for articles published in the non-letters portions of the principal journals.

The standard average length that pertains for all of the major journals is evidently not driven by the page charges, or lack of page charges. The page-charge rates for Part 1 of the ApJ and for the AJ are currently $150 per paper page and $105 per electronic page. A&A has no direct page charge for authors from the sponsoring member countries, but charges €100($135) per page for other authors; the MNRAS also has no page charge, being supported by subscriptions.

As is the case for the main (i.e. non-Letter) portions of the journals, the average page length for a Letter, shown in Fig. 12, has remained quite constant, although unlike the situation with the main journals, the length of Letters papers is subject to very strict editorial constraints. Submissions to Part 2 of the ApJ, the Letters, must not exceed four printed pages, although one, or at most two, additional pages are occasionally allowed for full-page displays of images, if judged appropriate by editorial decision. After a gradual growth of about one page per Letter in the MNRAS, the average length has remained constant. Special Issues result in some irregularities: for example, in 2001 A&A Letters had a lengthy special issue on First Results from XMM-Newton, and in 2003 one on "First Science with INTEGRAL." Harris (1983) had noted that Letters in the astronomical literature tended to become longer with time, during the period before his publication; evidently that trend has been successfully countered during

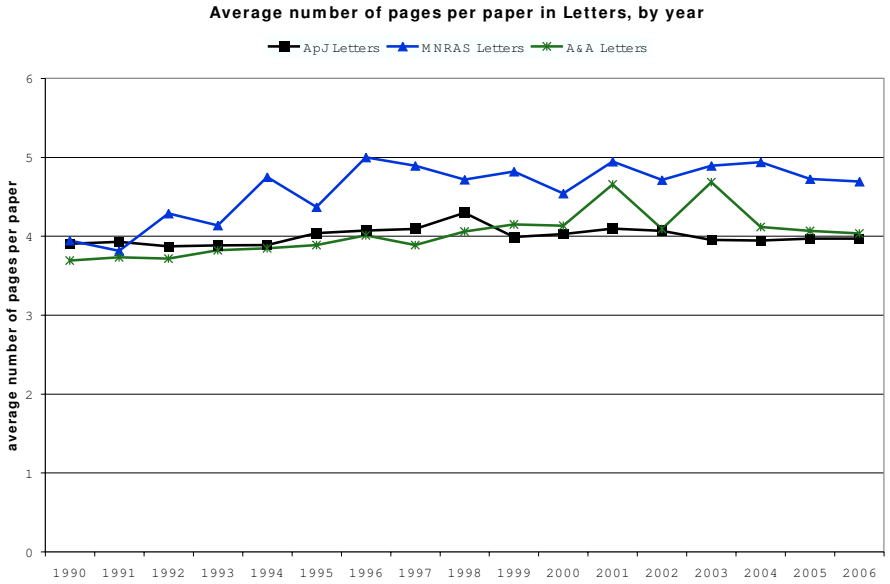

Figure 12. Average number of pages per paper, by year, for articles published in The Astrophysical Journal Letters and in the Letters portions of the Monthly Notices and Astronomy & Astrophysics.

the past decade, presumably by strict editorial enforcement of the length limits.

Currently the average number of pages per paper published in The Astrophysical Journal Supplement Series is about 20, as shown in Fig. 13, but the trend is towards fewer pages per Supplement paper: most Supplement papers would now, in fact, fit within the 20-page nominal length limit of Part 1 of the ApJ. (This nominal length guideline is now being relaxed for papers in Part 1, and will in any case be less crucial in the electronic-only era.) Length is only one of several criteria that suit a manuscript for publication as an ApJ Supplement: certain instrumentation papers, compilations of relatively uninterpreted data, numerical models, computational algorithms, and other papers, important but with a restricted readership, also are considered for the Supplements. Special issues, for example focused on a particular set of results such as the first Spitzer science papers, have also been published to good effect in the Supplements. (Not all authors realize that the ApJ Supplement Series is the most widely cited of any of the major journals in the field of astronomy and astrophysics.)

The average number of authors involved in the preparation of a paper, as shown in Fig. 14, has approximately doubled during the period since 1990. The principal journals are consistent not only in the trend for the number

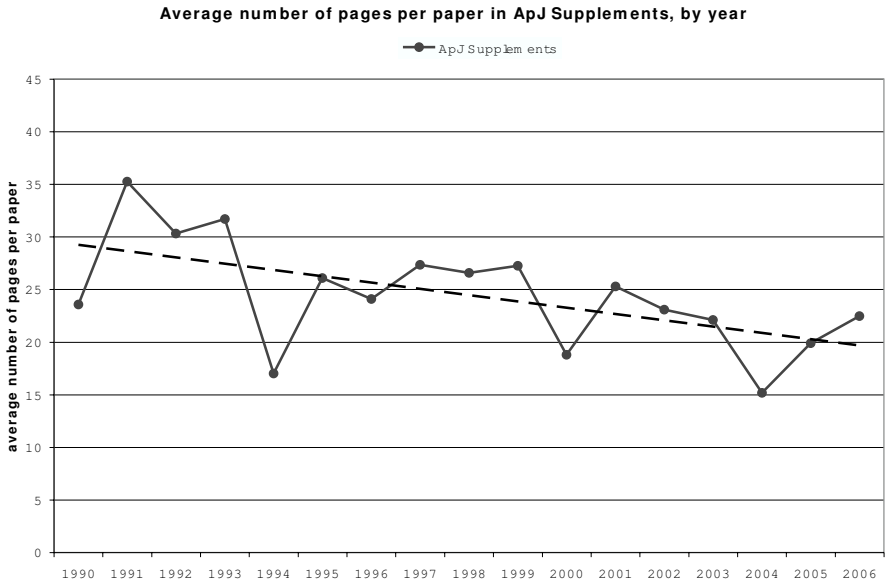

Figure 13. Average number of pages per paper, by year, in the Supplement Series of The Astrophysical Journal.

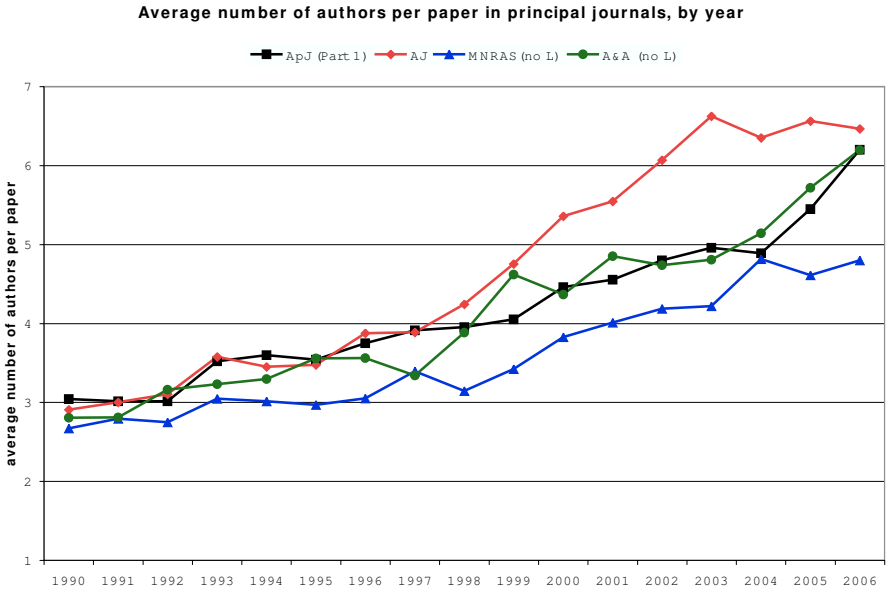

Figure 14. Average number of authors per paper published in the non-Letters portions of the principal journals, by year.

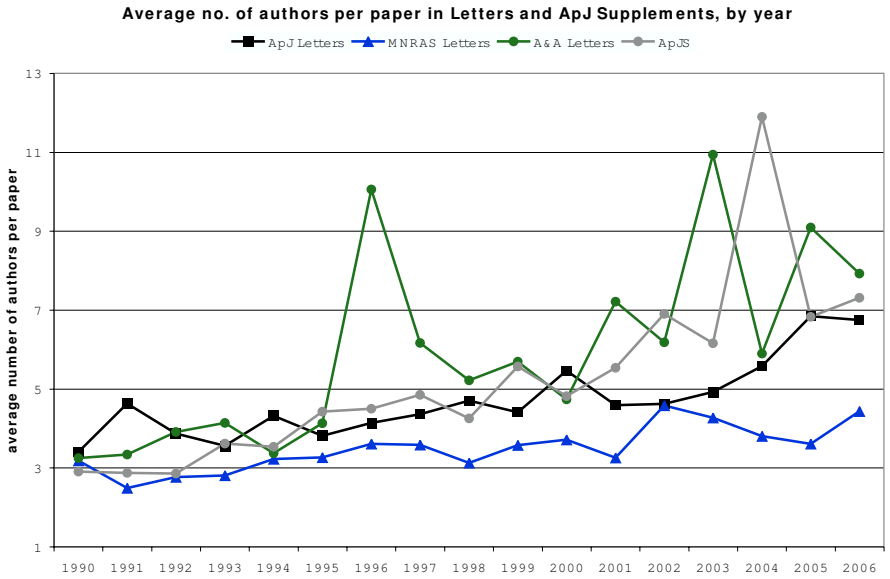

Figure 15. Average number of authors per paper published in The Astrophysical Journal Letters, in the Letters portions of the Monthly Notices and of Astronomy & Astrophysics, and in The Astrophysical Journal Supplement Series.

of authors per paper to rise, but also in the value of the average number of authors. The Astrophysical Journal and Astronomy & Astrophysics trace each other very closely; but during the past decade about one additional author contributes to papers in the Astronomical Journal, and about one fewer author, on average, contributes to papers in the Monthly Notices. Although the journals formally welcome manuscripts from all fields of astronomy, certain customs have been established: it is plausible, for example, that theoretical papers on cosmology or galaxy dynamics, that appear regularly in the MNRAS, involve smaller teams than the contributions based on major observational efforts, that appear regularly in the AJ.

The trend toward more authors per paper probably reflects several causes. Some of these causes may be intrinsic to the science being performed: more recent papers are more likely to be based on data from several different wavelength regimes, and thus involve authors of varying expertise. Other causes of the trend may be of a more sociological nature: names that several decades ago might have appeared only in the acknowledgements, are now more likely to appear in the list of authors. Trimble (1984) has discussed more of these possibilities.

As is the case for the non-Letter portions of the journals, the average number of authors per Letter, as shown in Fig. 15, has increased steadily

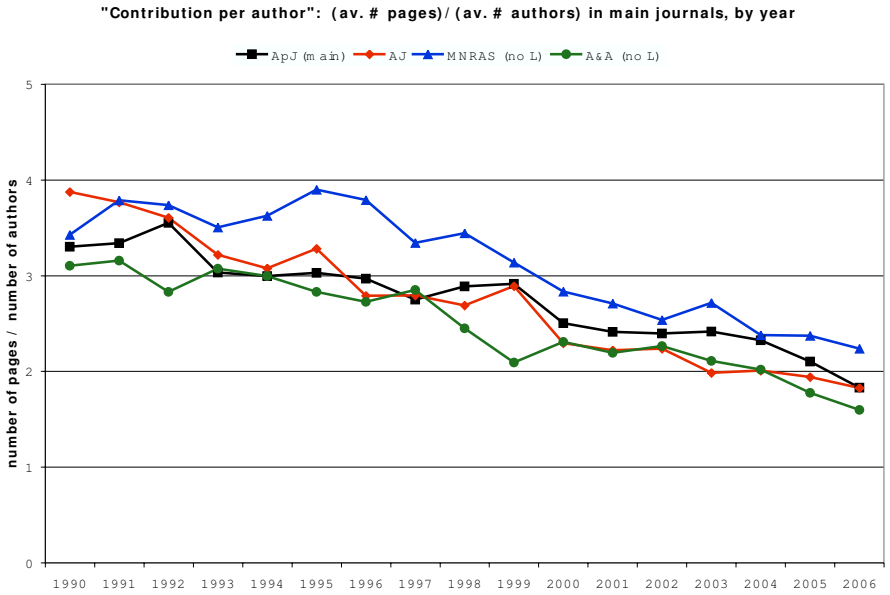

Figure 16. Change since 1990 of the "effective contribution per author", defined as the average number of pages of a manuscript divided by the average number of authors, for the main (i.e. non-Letter) portions of the principal journals.

since 1990. The average number of authors of an Astrophysical Journal Letter has more than doubled since 1990, as has the number of authors of ApJ Supplements. Relatively fewer authors contribute to each Letter in the Monthly Notices. The spikes in the distributions correspond to "Special Issues" anomalies, including issues dedicated to the Spitzer mission (ApJS vol. 154, 2004), to first results from the INTEGRAL spacecraft (A&AL vol. 411, 2003), and to the ISO mission (A&AL vol. 315, 1996).

Fig. 11 showed that the average number of pages per typical main-journal paper has remained more or less constant, or has increased only gradually, since 1990; Fig. 14 showed that the average number of authors involved in each paper has increased more strongly than the length of a typical paper. Therefore, what one might term the "effective contribution of each author", measured as the number of pages in a paper divided by the number of authors, as shown in Fig. 16, has decreased in a regular manner. The trends of all of the major journals are quite similar.

The average length of a Letter in either Part 2 of The Astrophysical Journal or in Astronomy & Astrophysics has remained constant, at only slightly more than 4 pages; the average Letter in the Monthly Notices has remained constant at about 5 pages. The downward trend shown in Fig. 17 is due to the increasing average number of authors per Letter. In 1990, each

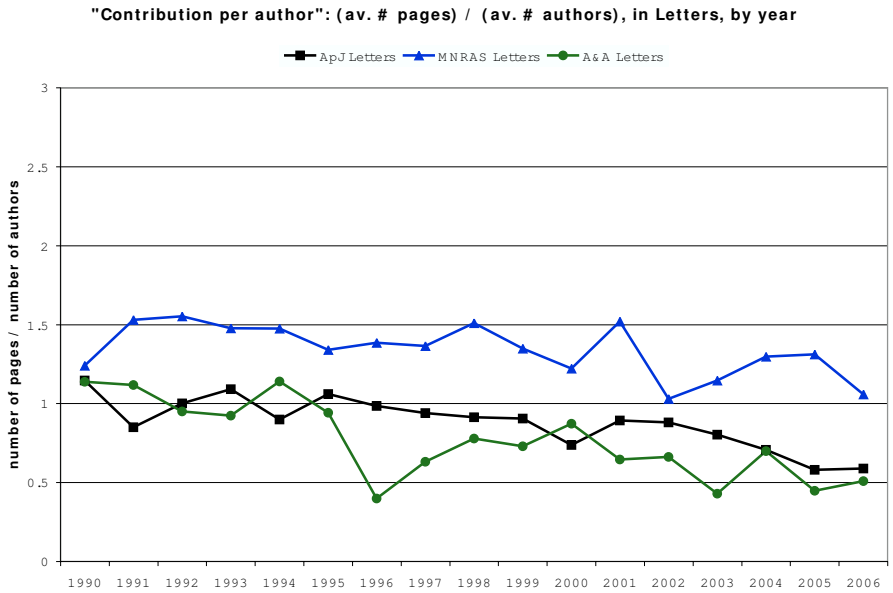

Figure 17. Change since 1990 of the "effective contribution per author", defined as the average number of pages of a manuscript divided by the average number of authors, for The Astrophysical Journal Letters and for the Letters portions of the Monthly Notices and of Astronomy & Astrophysics.

author effectively contributed 1.2 pages to each ApJ Letter, but in 2006, each author contributed half that amount. The anomalies in the A&A trend as plotted for the years 1996 and 2003 are due to the ISO and INTEGRAL special issues, respectively.

Fig. 18 shows that the frequency distribution of the number of pages per paper published in Part 1 of the Astrophysical Journal. The upturn in the distribution for single-page papers published in Part 1 of The Astrophysical Journal corresponds mostly to errata, and to some editorials. The shoulder at 5 or 6 pages probably reflects manuscripts that were originally submitted to Part 2 of the ApJ, the Letters, but which were not able to meet the stringent 4-page length limit and which thus by editorial decision were diverted to Part 1. There is no obvious shoulder in the page-length distribution near 20 pages: such a shoulder might be expected if the guidelines for the nominal 20-page length limit for papers published in Part 1 were strictly enforced. (Note that two of the periods refer to a six-year duration, while one refers to a five-year span.)

For the decade beginning in 1990, there was a trend for the number of long papers in Part 1 of The Astrophysical Journal to increase: the percentage of papers longer than 20 pages doubled between 1990 and 2000.

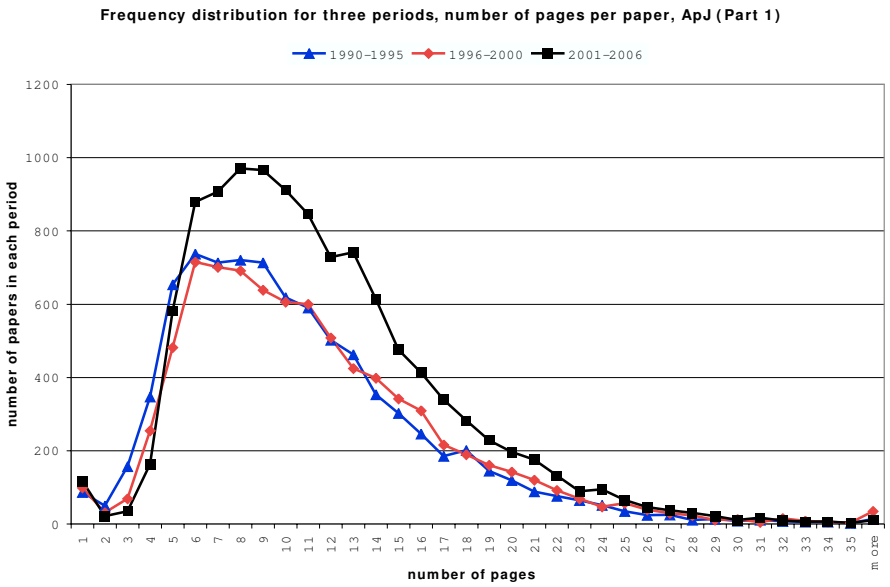

Figure 18. Frequency distribution of number of pages per paper published in Part 1 of The Astrophysical Journal, plotted separately for the three indicated periods.

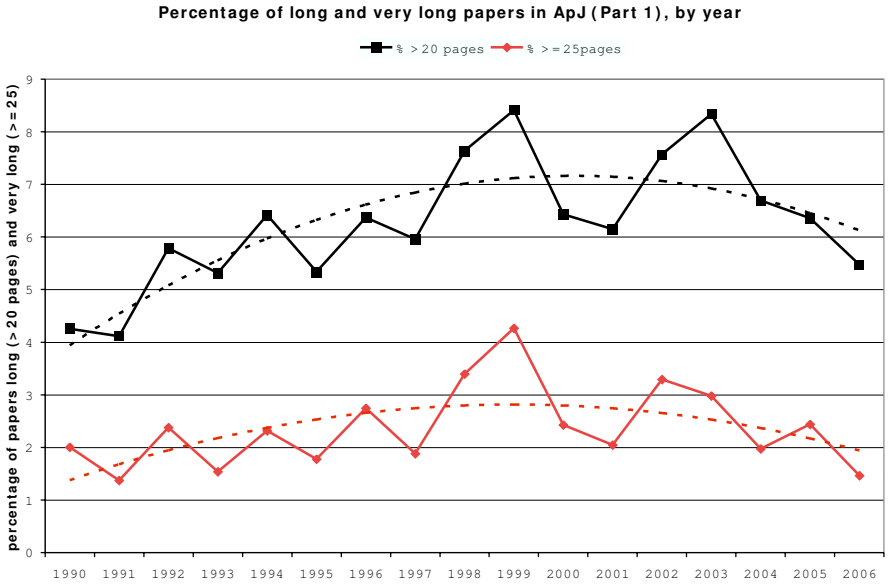

Figure 19. Percentages of papers published in Part 1 of The Astrophysical Journal since 1990 that are longer than 20 pages or 25 or more pages in length.

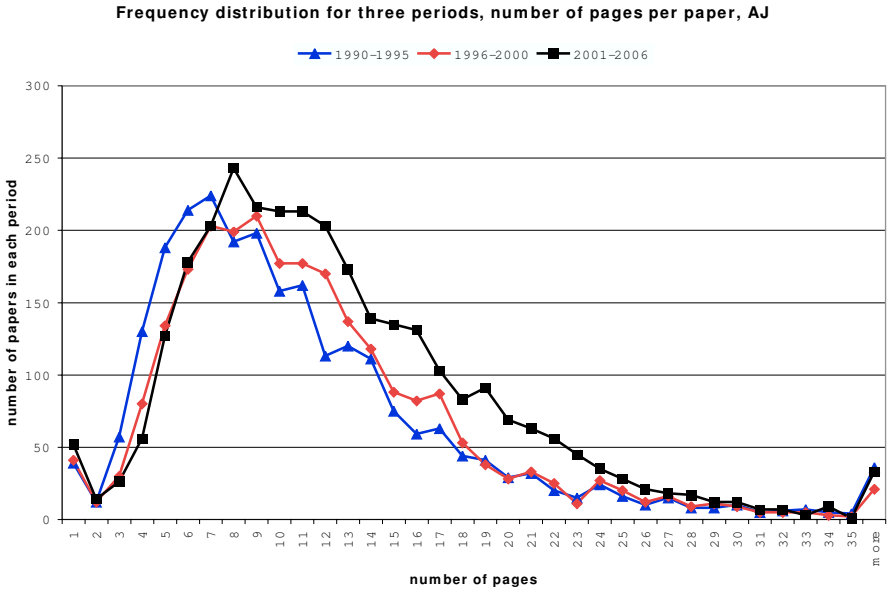

Figure 20. Frequency distribution of number of pages per paper published in the Astronomical Journal, plotted separately for the three indicated periods.

But during the past 4 or 5 years, the trends shown in Fig. 19 suggest some decrease in the percentage of long papers. This decrease is due at least in part to the option of including lengthy tables, in machine-readable form, only in the electronic edition.

Fig. 20 shows the frequency distribution of the number of pages per paper published in the Astronomical Journal. The upturn in the distribution for single-page papers published in the Astronomical Journal corresponds mostly to errata, and to some editorials. There is no shoulder, comparable to that shown for the ApJ distributions, in the AJ distributions at 5 or 6 pages, probably because the AJ does not publish Letters. The AJ has no explicit length-limit policy.

Fig. 21 shows the frequency distribution of the number of pages per paper published in the Monthly Notices. The upturn in the distribution for single-page papers published in the Monthly Notices corresponds mostly to errata, and to some editorials. The shoulder at 6 or 7 pages probably corresponds to the length limitation of about 5 pages for Letters published in the MNRAS, which results in some over-length submissions to the Letters being published in the main portion of the journal. The Monthly Notices has no formal page-limit policy.

The frequency distribution of the number of pages per paper published in Astronomy & Astrophysics, shown in Fig. 22, follows the same global

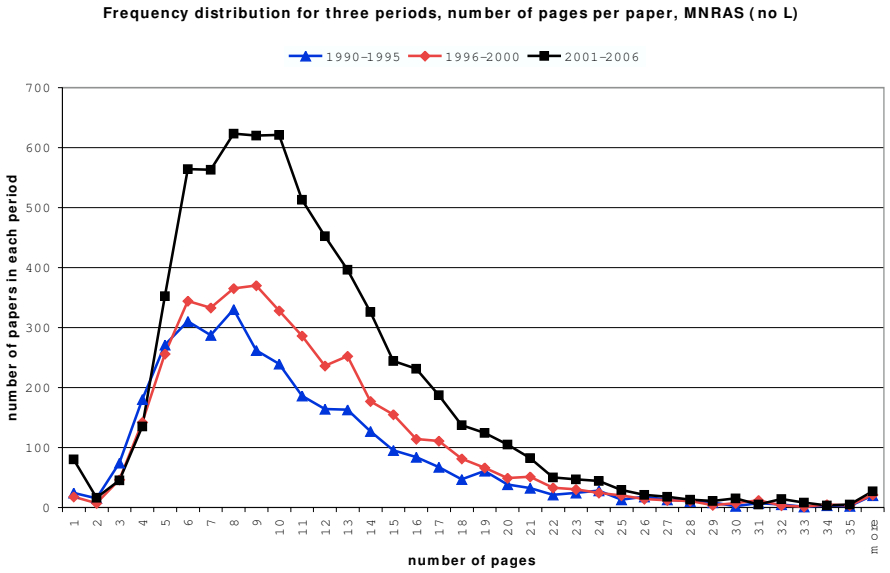

Figure 21. Frequency distribution of number of pages per paper published in the Monthly Notices of the Royal Astronomical Society, plotted separately for the three indicated periods.

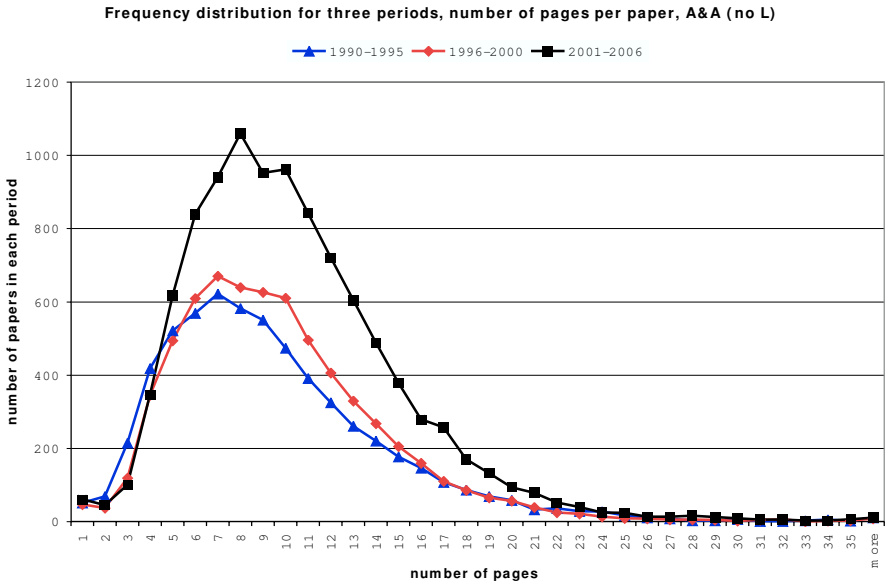

Figure 22. Frequency distribution of number of pages per paper published in the non-Letters portion of Astronomy & Astrophysics, plotted separately for the three indicated periods.

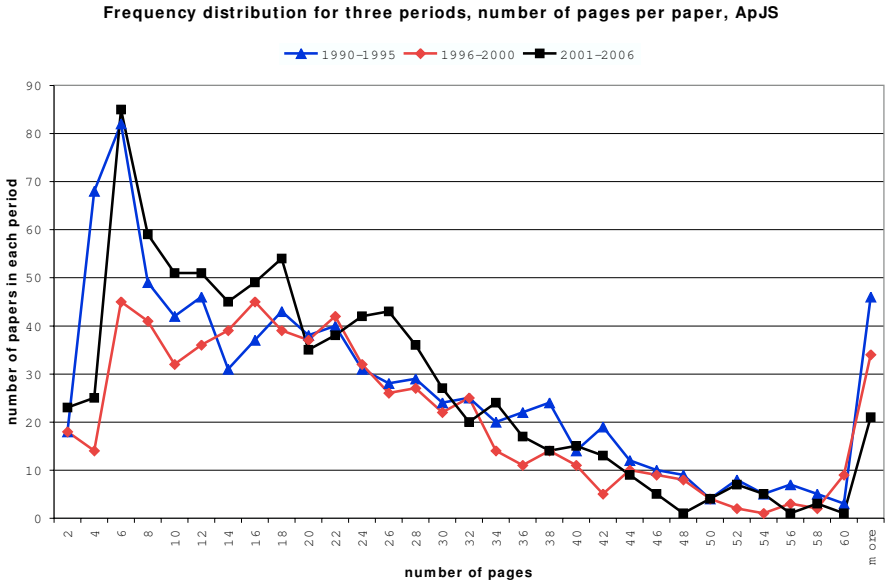

Figure 23. Frequency distribution of number of pages per paper published in the Supplement Series of The Astrophysical Journal, plotted separately for the three indicated periods.

trends as displayed by the other principal journals. A&A has no formal page-limit policy.

Many lengthy papers are published in The Astrophysical Journal Supplement Series, but, as shown by Fig. 23. But Fig. 24 indicates that more than half of the papers in the Supplements amount to less than 20 pages, i.e. within the nominal length limitations - currently being relaxed – of Part 1 of the ApJ.

More than half of the papers currently published in The Astrophysical Journal Supplement Series are shorter than 20 pages, and the average length is slowly but steadily decreasing. Most papers published in the Supplements are deemed appropriate for that journal for reasons other than length.

The normalized page-length distributions shown in Fig. 25 are remarkably similar for the principal journals. Evidently the page charges for The Astrophysical Journal and the Astronomical Journal do not constrain the length of papers, compared to the situation pertaining for the Monthly Notices, that has no page charge, or for Astronomy & Astrophysics, that has no (direct) page charge for most European authors. (Recently A&A member countries have been expanded to include Argentina, Brazil, and Chile.) Ironically, the AAS page charges do not result in relatively fewer long papers for the ApJ or AJ; in fact, both of the AAS journals publish

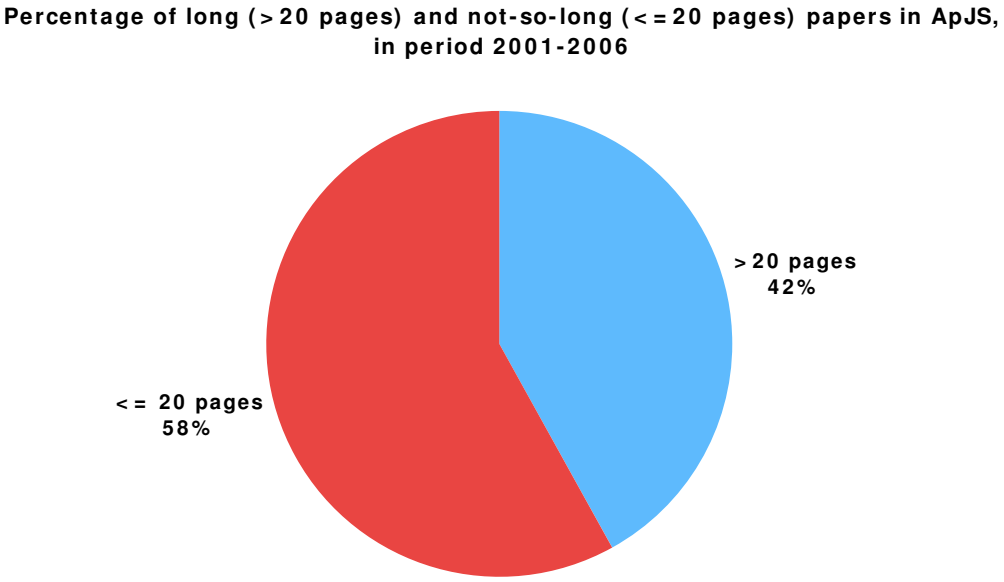

Figure 24. Percentages of papers published in the Supplement Series of The Astrophysical Journal, in the period 2001-2006, that are longer, and shorter, than 20 pages.

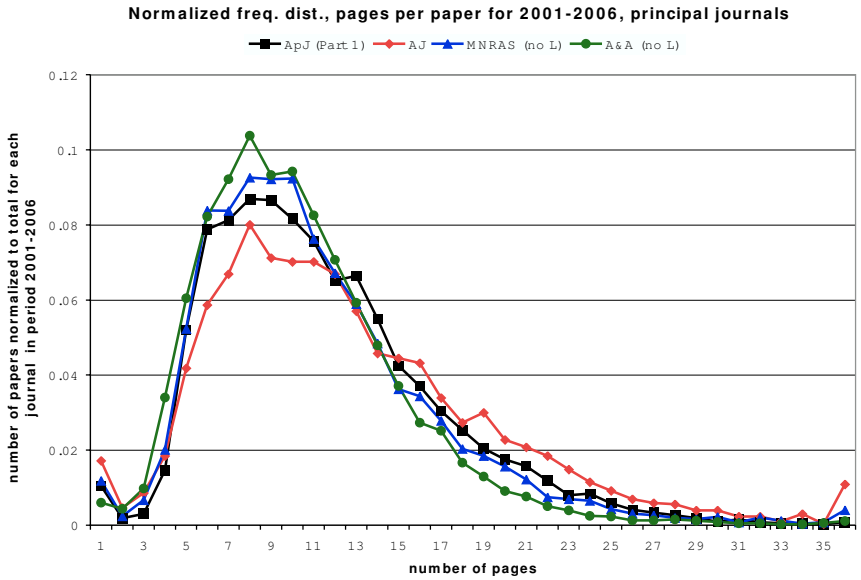

Figure 25. Frequency distribution of the number of pages per paper normalized to the total number of papers for each journal published, in the period 2001-2006, in the non-Letters portions of the principal journals.

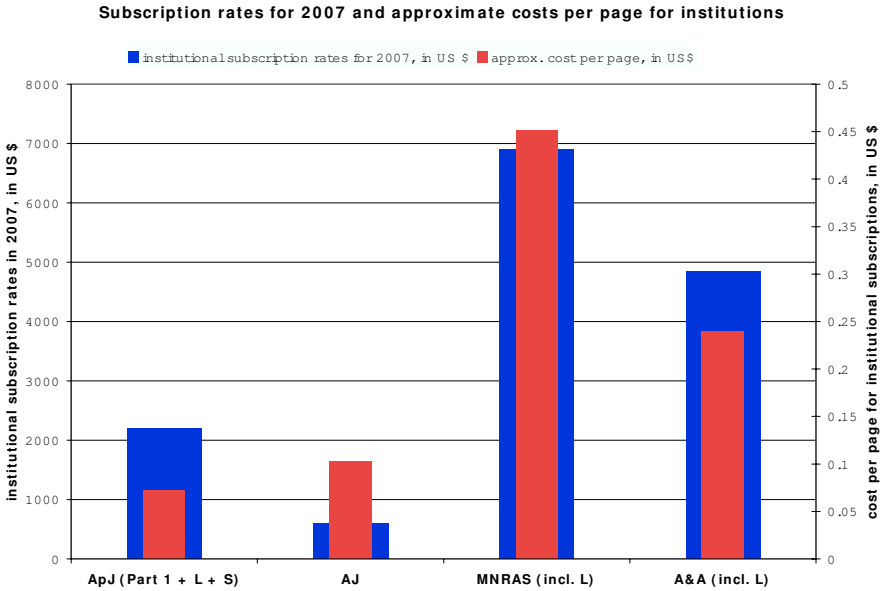

Figure 26. Rates in 2007 for institutional subscriptions for the principal journals, and the approximate cost per page for institutional subscriptions.

relatively more rather lengthy papers than the journals that do not impose (direct) page charges. The nominal page-length limit of 20 pages set by ApJ policy evidently is not enforced to result in fewer long papers in that journal. (No corrections have been applied to account for the somewhat differing word densities, or for slightly different paper formats, for the four journals considered.)

The ApJ and AJ are supported by page charges: authors must themselves arrange for payment, either from their institution, their own grants, or otherwise, before an article is published. (Page-charge waivers are only very rarely granted.) The MNRAS is supported by subscriptions, with no page charges to the authors; A&A is supported by levies on the member countries and by subscriptions, and thus also does not have direct page charges for authors working in the sponsoring countries. It is interesting to compare the institutional subscription rates for the four principal journals. (The incomes from these subscriptions greatly exceed those from individual subscriptions.) The rates shown in Fig. 26 pertain to the combined paper and electronic material. The institutional subscription rate for 2007 for the ApJ, Parts 1 and 2 as well as the Supplement Series, is $2200; for the AJ, the rate is $600. The 2007 institutional subscription rate for the MNRAS is $6906; for A&A, the rate is €3559, or $4840 at the exchange rate of €1 = $1.36. (These rates refer to the journals being delivered in the US.)

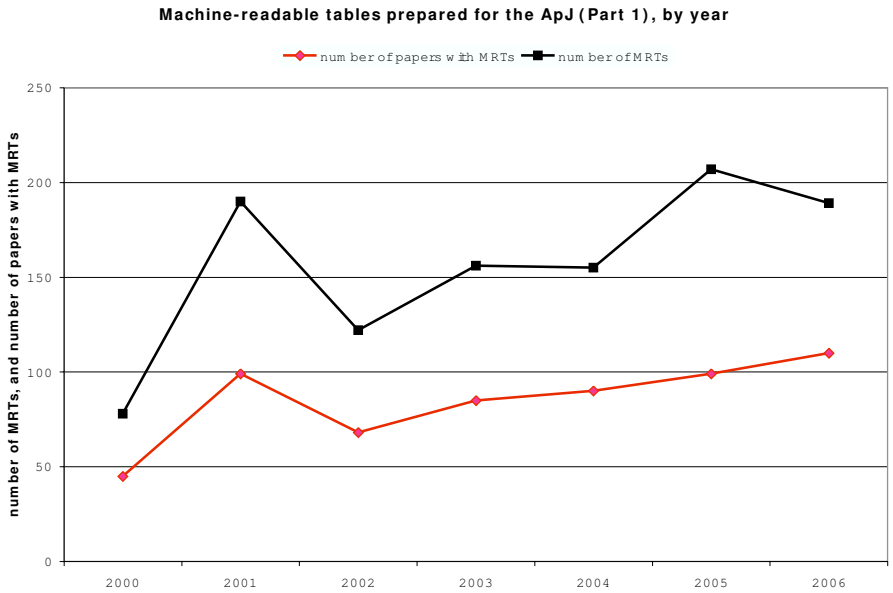

Figure 27. Number of machine-readable tables prepared for Part 1 of The Astrophysical Journal, by year.

The yearly rates for individuals are much lower. The ApJ, Parts 1 and 2 together, costs $315 for members of the AAS; the ApJS costs $55. The annual AJ rate for individuals is $140, for the print plus electronic versions. The MNRAS individual rate for 2007 is $879; that for A&A, €552, or $740. The approximate cost per page to institutional subscribers was calculated by finding the number of pages in the full volume of each journal completed most recently (to July 2007), multiplying this by the number of volumes per year for each journal (18, 2, 9, and 16, respectively for the ApJ, AJ, MNRAS, and A&A), and then dividing expected number of pages for the journals (30330, 5816, 15282, and 20224, respectively) by the institutional subscription rate for 2007.

Beginning in 2000, Greg Schwarz (ApJ/AJ Editorial Staff Scientist) has recorded the number of machine-readable tables, shown in Fig. 26, that he has prepared for the AAS journals, either as stubs or as full tables in the electronic editions. Both the number of MRTs prepared for Part 1 of the ApJ, and the number of papers that include one or more MRT, have increased. This increase is plausibly substantially responsible for the currently declining number of long papers published in the Part 1 of the ApJ, as shown in Fig. 19. When Greg Schwarz began the MRT project, the initiatives for electronic-only material came largely from him, not from the authors; but currently authors themselves usually ask for the service. (The

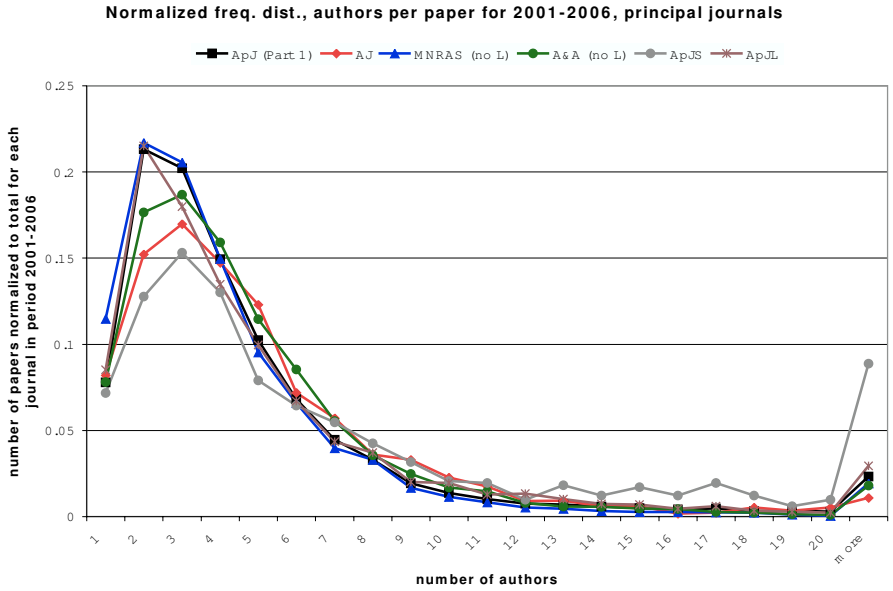

Figure 28. Frequency distribution of the number of authors per paper normalized to the total number of papers for each journal published in the period 2001-2006.

dates indicated refer to when the completed MRTs were returned to the University of Chicago Press for typesetting, not to the date of publication.)

Fig. 28 shows that the normalized authors-per-paper distributions are remarkably similar for the principal journals, just as the pages-per-paper distributions are similar. Evidently custom or habits result in a rather "standard" manuscript for the principal scholarly journals in astronomy.

The similarities between the four principal journals will have a number of advantages for authors. A manuscript may be prepared with little attention paid to the requirements of a particular journal. A decision to submit the manuscript to one, rather than another, journal might involve little more than a change of the LaTeX macro. If a manuscript experiences a troublesome peer review, authors may with little additional work submit their work to one of the other journals. (Impermeable firewalls separate the journals' peer-review processes.)

The statistics shown in this report pertain mostly to the period since 1990; but it is interesting to view a longer timeline, and to note that the journals took their present profiles after about 1970. Fig. 29 shows the number of papers published annually in the principal journals since 1950. Through 1959, reports from (quite commonly private) observatories were published in the Monthly Notices, together with obituaries and notices of RAS affairs. Through 1968, abstracts of presentations at the AAS meet-

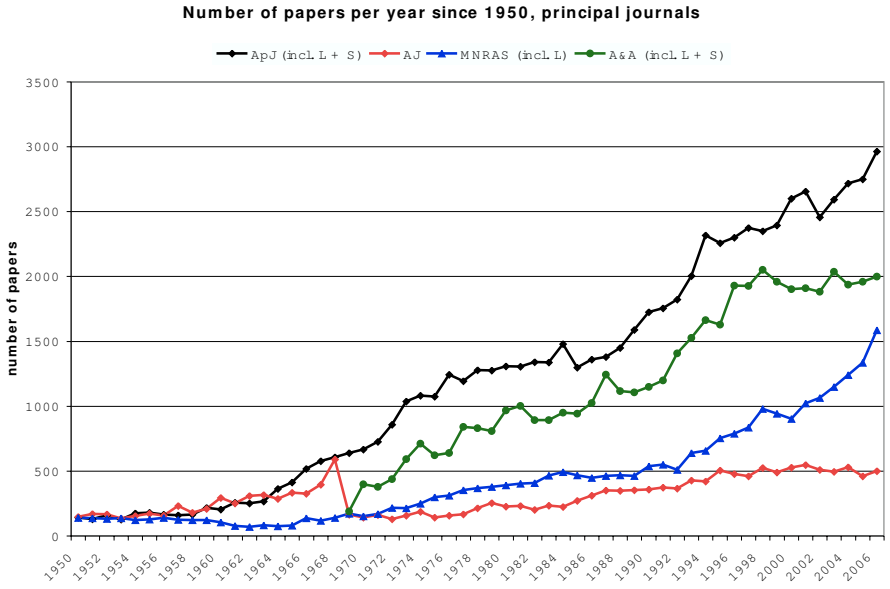

Figure 29. Number of papers published per year since 1950, in the principal journals including the Letter and Supplement portions.

ings were included in the Astronomical Journal, together with obituaries and reports from observatories and academic departments: such material is now printed in the separate publication, the Bulletin of The American Astronomical Society. Astronomy & Astrophysics commenced publication in 1969, combining six established European national publications; the A&A Supplements were published from 1970 through 2000.

The strong growth in the number of authors publishing in the principal journals since the 1950s, as shown in Fig. 30, is well known. Various aspects of this growth have been discussed by in some detail by Trimble (1984); although her paper described the situation before the dramatic growth that began in the early 1990s, many of the scientific and sociological reasons given in that paper probably still apply. (Note that prolific individuals may be counted several times in a single year.)

Although the number of papers published in each of the journals increased strongly since 1950 (as Fig. 29 shows), the number of authors who contributed these papers (as shown in Fig. 30) rose even more strongly. The quotient of the number of papers divided by the number of authors, as shown in Fig. 31, decreased regularly, with the principal journals following a common trend.

Before 1969, a single author contributed most papers published in The Astrophysical Journal. The trend to larger and larger teams of co-authors

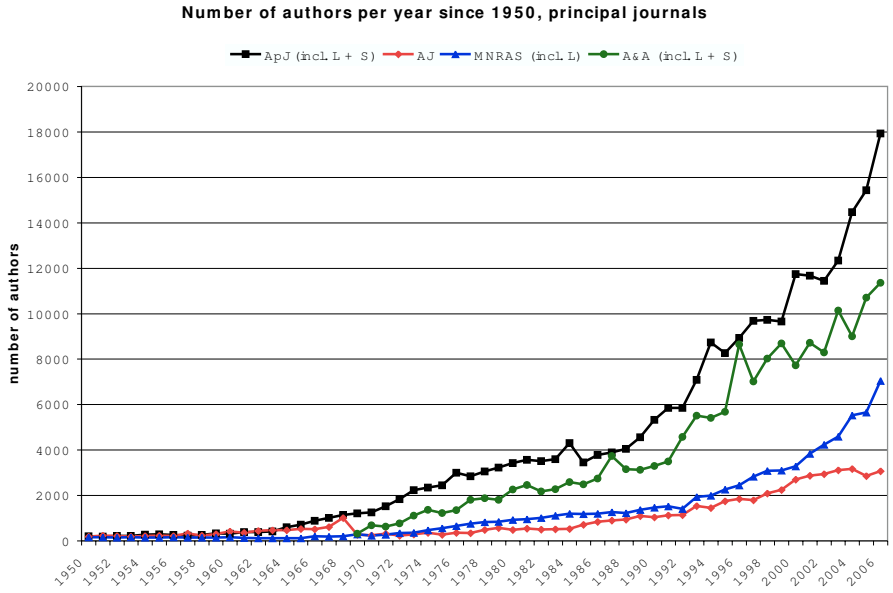

Figure 30. Number of authors publishing per year since 1950, in the principal journals including the Letters and Supplements portions.

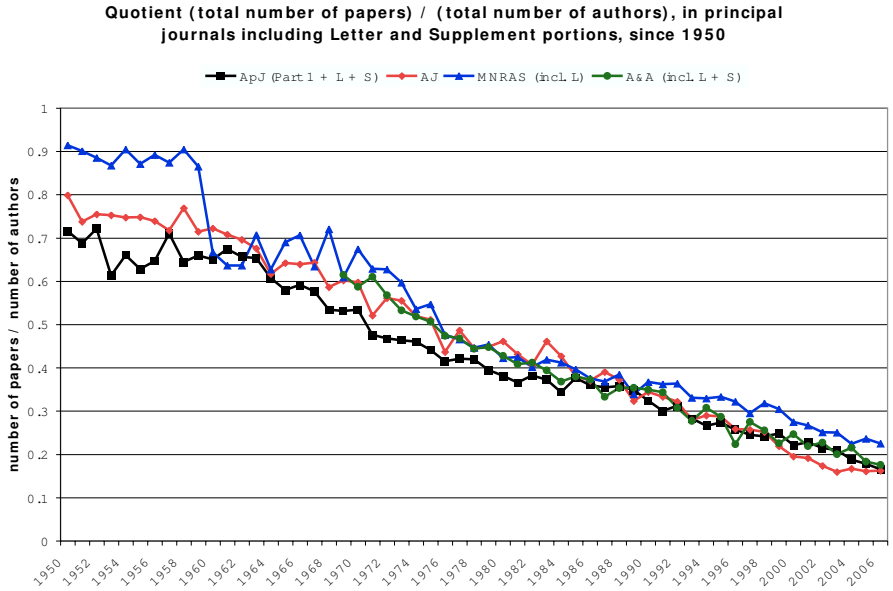

Figure 31. Quotient of the total number of papers divided by the total number of authors who contributed these papers to the principal journals, since 1950.

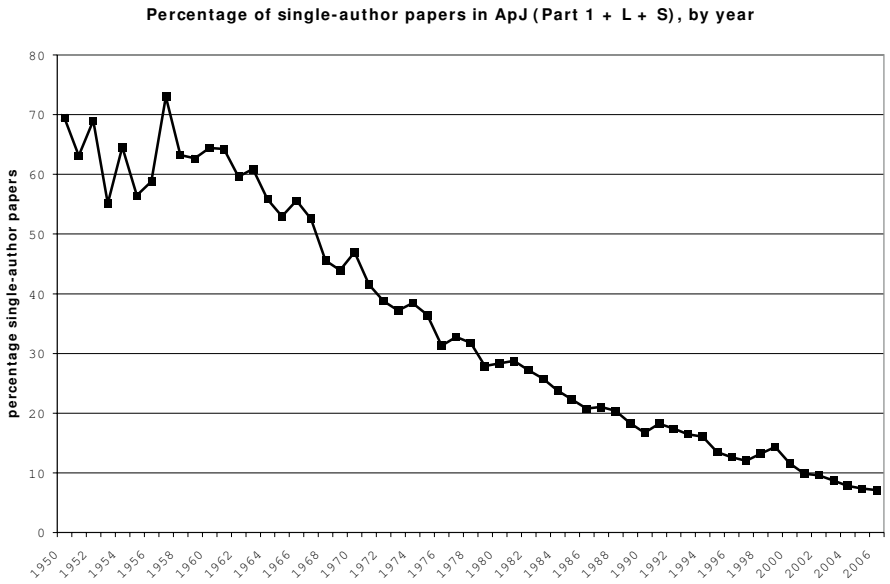

Figure 32. Percentage of papers published in The Astrophysical Journal that were written by a single author, by year since 1950.

has been a consistent one: papers written by a single author are now rare, as Fig. 32 shows. A smooth fit to the behavior since about 1965 suggests an asymptotic leveling of the trend to a non-zero value. Abt (2007b) has measured the trends for single-author papers during the period 1975-2005 generally across the disciplines of astronomy, physics, chemistry, and biology, and predicts that for these disciplines single-author papers will not become extinct in the foreseeable future.

The material presented here for the four principal scholarly journals in the field of astronomy and astrophysics support some general conclusions:

1. The number of papers published per year in the non-Letters portions of the principal journals has grown steadily and approximately linearly since 1990. The number of Letters published in the ApJ, MNRAS, and A&A more than doubled.
2. The number of papers published in the AAS journals, the ApJ and AJ, increased somewhat more rapidly than the membership count of the AAS.
3. The percentage of papers published in the ApJ (Part 1) with first authors affiliated with a North American institution has remained constant at about 69%; first authors at European institutions account for about 20% of the papers in the ApJ.

4. The quotient of number of papers published per year in the ApJ and submitted by North American authors, per AAS member, has increased since 1990.
5. The introduction of major new observational facilities resulted in shifts in emphasis, but not in surges in the total number of papers; this was first pointed out by Abt (2006, 2007a).
6. The average numbers of pages per paper for the four journals considered have remained almost constant since 1990, and differ little amongst the journals.
7. Most papers published in the ApJ Supplement Series are shorter than 20 pages.
8. The average numbers of authors per paper have approximately doubled since 1990 for the four principal journals, and are quite consistent for these journals; this growth is probably due partly scientific considerations, and partly to sociological ones.
9. Because the average paper lengths have remained constant, but the numbers of authors per paper have increased, the"effective contribution per author" has decreased regularly.
10. The frequency distributions of the number of pages per paper are quite similar for the four principal journals. There is no evidence that the page charges levied directly on authors by the AAS journals, but not by the MNRAS or A&A, inhibit page length.
11. The nominal length limit of 20 pages specified by ApJ guidelines is evidently not effectively enforced; few very long papers are published by any of the principal journals.
12. The consistencies across the principal journals suggest that customs or habits result in a "standard" paper, of length 9 pages (with half-maximum values at about 5 and 15 pages), written by 3 co-authors (with single-author papers about as common as 6-author papers). This consistency probably has some practical advantages for the community of authors.
13. The principal journals have shown their current profiles since about 1970.
14. Since 1950, the numbers of papers published in the principal journals have increased in a regular manner, but the increases in numbers of authors contributing these papers have been much stronger.
15. The percentage of single-author papers in the ApJ continues to decrease monotonically.

Acknowledgements

I am grateful to Edwin Henneken, of the Smithsonian/NASA Astrophysics Data System staff at the Harvard-Smithsonian Center for Astrophysics, for providing me with master files for the various journals from which I extracted these statistics and for introducing me on several occasions to some of the more elaborate capabilities of the ADS, to Greg Schwarz, ApJ/AJ Editorial Staff Scientist for the American Astronomical Society, for information on the growth of on-line-only material, and to Virginia Trimble for comments on a draft version of these notes.

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