

display especially of half-tones. Also, the enormous amount of information that can be stored e.g. on a CD-ROM may tend to induce a less frequent distribution. But the worse problem is with the lack of standardization of the hardware and software, a problem which seems inescapable due to obvious commercial reasons over which we have absolutely no handle: can it be solved at all?

## Conclusion

While most astronomy journals are rapidly evolving towards publication of papers prepared by the authors in elec-

tronic form, they are still printed on paper. This cannot last for very long, although paper copies will probably remain necessary at least for some time for archiving in the main libraries. Authors, editors and publishers have to start thinking seriously about future ways of publication of journals in electronic form. Fortunately we are still able to master the solutions. We in Europe are just starting an active reflection, which to my opinion should be independent initially from that of our American colleagues because the problems are different, the European journals being mainly commercial enterprises. It is clear that very soon the reflection and the corresponding actions will become

organized worldwide, thanks to the excellent cooperation between the Editors of the major astronomy journals. I am confident that when we will decide to turn actually to electronic publication, we will agree on common principles and standards for the benefit of the whole astronomy community. But as a preliminary and necessary step, we need to know the opinion of the future customer. This is why I have written this paper: I hope to receive soon many comments and propositions which are necessary to feed our reflections and to avoid doing bad mistakes.

I wish to thank André Heck for his interest and for interesting discussions and criticisms.

# Astronomy Acknowledgements Index 1991

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Every astronomer knows that ordinarily many people (not only the authors of the resulting paper) contribute to a scientific research project. It is not necessary to say how important it is to discuss a work with colleagues, to get a good advice or criticism, to receive data prior to publication, etc. Almost all astronomical papers include, in addition to a list of references, a list of acknowledgements. But very often we overlook this section of the paper, where names are usually hidden among numbers of grants.

Table 1: General statistics of AAI-1991.  $N_{\text{pap}}$  is the number of papers,  $N_{\text{ack}}$  the number of acknowledgements.

	<i>ApJ</i>	<i>ApJS</i>	<i>A&amp;A</i>	<i>A&amp;AS</i>	<i>MNRAS</i>	<i>AJ</i>	<i>Nat</i>	Total
$N_{\text{pap}}$	1635	90	977	169	544	368	102	3885
$N_{\text{ack}}$	5203	393	2377	419	1282	1388	313	11375
$N_{\text{ack}}/N_{\text{pap}}$	3.18	4.37	2.43	2.48	2.36	3.77	3.07	2.93

Looking through the leading astronomical journals in 1991, I have compiled an *Astronomy Acknowledgements Index*, which contains references to all

personal acknowledgements from the *Astrophysical Journal* (including *Letters*), the *Astrophysical Journal Supplement Series*, *Astronomy and Astrophysics*

Table 2: The 21 most-acknowledged scientists from astronomy and astrophysics journals in 1991.

Name	Affiliation	<i>ApJ</i>	<i>ApJS</i>	<i>A&amp;A</i>	<i>A&amp;AS</i>	<i>MNRAS</i>	<i>AJ</i>	<i>Nat</i>	Total
J. J. Binney	Theoretical Physics, Oxford University, UK	7		2		6			15
R. D. Blandford	California Institute of Technology, Pasadena, USA	15		2		1	1	1	20
P. T. de Zeeuw	Sterrenwacht Leiden, Netherlands	5		2		7	1		15
B.T. Draine	Princeton University Observatory, USA	14	1			2		1	18
A. C. Fabian	Institute of Astronomy, University of Cambridge, UK	6		1		8			15
G. J. Ferland	Ohio State University, Columbus, USA	15				1	1		17
J. E. Gunn	Princeton University Observatory, USA	10				2	4		16
J. W. Harvey	National Solar Observatory, NOAO, Tucson, USA	11		2				3	16
R. P. Huchra	Harvard-Smithsonian Center for Astrophysics, Cambridge, USA	4	3	2	1	4	4	2	20
J. L. Kurucz	Harvard-Smithsonian Center for Astrophysics, Cambridge, USA	12	1	2		1	5		21
J. P. Ostriker	Princeton University Observatory, USA	17	1			2	1	2	23
B. Paczyński	Princeton University Observatory, USA	13		3	1	3	1	1	22
B. E. G. Pagel	NORDITA, Copenhagen, Denmark	5		4	1	6			16
J. E. Pringle	Astrophysics Division, Space Sciences Department of ESA	12		1		1	1		15
J. C. Raymond	Harvard-Smithsonian Center for Astrophysics, Cambridge, USA	13		2		1	2		18
M. J. Rees	Institute of Astronomy, University of Cambridge, UK	6		1		9		2	18
F. H. Shu	University of California, Berkeley, USA	15	1	2			1		19
S. Tremaine	CITA, University of Toronto, Canada	14					1		22
S. D. M. White	Institute of Astronomy, University of Cambridge, UK	12				8	1		21
R. Wielebinski	Max-Planck-Institut für Radioastronomie, Bonn, Germany			9	4	2			15
S. E. Woosley	University of California, Santa Cruz, USA	10	1	6			2		19

sics, *Astronomy and Astrophysics Supplement Series*, *Monthly Notices of the Royal Astronomical Society*, the *Astronomical Journal*, and from *Nature's* astronomical articles and letters. The *Astronomy Acknowledgement Index* (AAI) is original and does not overlap with the *Science Citation Index* (SCI). AAI-1991 includes 11,375 personal acknowledgements to 5605 people. (The last number probably is not exact. I have tried to take into account different combinations of first names and initials, but I cannot be sure that it has been done in all cases. On the other hand, namesakes are possible.) Acknowledgements are going to colleagues and referees, students and supervisors, telescope operators and software engineers, directors of observatories and institutes, wives and husbands, parents and friends, etc. All of these people contributed their efforts to Astronomy.

Statistical studies based on SCI (Garfield, 1977, 1985, Abt, 1980, 1981, 1983, 1984a, b, 1987, Rao and Vahia, 1984, 1986, Trimble, 1986) have discovered many interesting features of the astronomical science development. A list of 22 most-cited papers from astronomy and astrophysics journals covered in the 1945–1954 SCI cumulation was published and discussed by Brush (1990). Note that citation counts are not direct

indicators of the importance of papers (see, e.g., conclusions made by Leydesdorff and Amsterdamska, 1990).

The statistical analysis of AAI can give us useful additional information and throw light upon another aspect of the scientific process in astronomy. Table 1 shows the general statistics of AAI-1991. Table 2 includes the names of the 21 most-acknowledged persons (in alphabetical order) in 1991. All of them are well-known scientists, who are working in large astronomical centres with an active scientific life. Undoubtedly, they are very communicable people. Most of the gratitudes (79 %) were expressed to them for useful discussions and comments. Other thanks (23 %) were due to providing of data, theoretical models, and computer codes.

Table 2 reflects some advantage of American scientists. However, it should be taken into account that as a rule American papers include more acknowledgements than European ones (on the average, 3.34 acknowledgements per paper in the American journals versus 2.45 in the European journals).

The true significance and importance of papers will be determined only after years or even tens of years. On the other hand, they have immediate personal influence on today's scientific life. The count of acknowledgements is an es-

imator (of course, more or less relative) of this influence.

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Data from AAI-1991 are available upon request (Internet: dverner@eso.org, EARN/Bitnet: dverner@dgaeso51.bitnet). AAI-1992 is being compiled now.

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# On the Life Expectancy of Astronomers

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It has, on occasion, been said and proven by prominent singular examples that astronomers enjoy a higher life expectancy than their "normal" compatriots. There have been several attempts to prove this thesis with the use of statistical data. One such example was M. Ebell's survey of the life spans of 233 astronomers using data from the obituaries in the *Astronomical News* from June 1881 till March 1919. Ebell (1) calculated an average life span of 62.6 years – without however having compared the data with that of the general population. He also published the median life span of astronomers from various countries. The impact of this assertion remains shaky however, due to the small number of representative examples used (i.e. in this case only 10 astronomical personalities surveyed) to substantiate his findings.

Conversely to Ebell, D.W. Wattenberg (2) used the relevant life span data of 253 deceased astronomers from articles in the *Newcomb-Engelmann* (3) as well as obituaries in the *Vierteljahresschrift*

*der Astronomischen Gesellschaft* and calculated a median life span of 68.7 years for astronomers. Whereby it was noticed by Wattenberg that there seemed to be a distinct rising life expectancy in the course of time, e.g. before 1500: 51.0 yrs.; 16th century: 61.9 yrs.; 17th century: 67.7 yrs.; 18th century: 70.7 yrs.; 19th century: 69.1 yrs. The distribution of these examples over the various time spans and centuries reduced the number of the cases studied to a considerable extent. For the period before 1500 there were only 4 cases, for the 16th and 17th centuries only 16 cases and for the 18th century only 48 persons could be used – statistically seen, rather small numbers.

I was able to also come across a compilation of astronomer's life expectancies from the estate of Johann Heinrich Mädler of Göttingen (4). The data which he used for his work *The History of Astronomy*, lists – without mentioning exact sources and time spans however – the ages of a total of 427 astronomers, for whom he calculated an average life

span of 67.8 years.

The impact of these assertions remains unsatisfactory because of the lack of comparison to similar data for the rest of the population. Thanks to the dynamic growth of life expectancy in the industrialized countries, especially from the middle of the 19th century, a clear definition of a period is particularly necessary, as are comparative counts within the general population for the same period under study.

In order to avoid the shortcomings of previous studies, the following study only indicates persons described in my book *The History of Astronomy* (5) and it uses comparative information about the general population (limited however exclusively to Germany) which was deduced from original source material with the greatest care (6).

Since I had access only to data about the general population for the period between 1740–1859, I limited my data to 170 astronomical personalities born between 1715 and 1825, from whom I again selected 67 who began their