

The Future of Astronomy Publications: Electronic Publishing?

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Everyone will acknowledge that the present situation of publication of primary journals (i.e. those journals presenting original scientific results) is far from satisfactory. Journals are expensive, cumbersome and slow to come. They contain a lot of information of little interest for a particular scientist, and the information he or she is really interested in is difficult to retrieve. A general opinion seems to be that, in spite of the advantages of the journals in their present paper form, a radical change is needed and will undoubtedly occur in the near future. Electronic publication is obviously the way to go; however we only start to imagine what it could be in practice, and there are certainly pitfalls to avoid. As I will show, astronomers will presumably be amongst the first to lead the way in this mutation. While this may be satisfactory for our proper pride, being a guinea pig is never comfortable: we will also be amongst the first to fall in the pit if we are not careful enough. We must consider the problem very seriously and think very hard, first on what we want and second on the way of achieving it.

For me the story started very recently. The opportunity was the colloquium entitled "Desk-Top Publishing in Astronomy and Space Sciences" held in Strasbourg on October 1–3, 1991. The chairman of the Scientific Organizing Committee, André Heck, asked me to present a review on the experience of *Astronomy and Astrophysics* and other astronomy journals with desktop publishing (desktop publishing means the preparation by the authors of manuscripts ready to publish, or almost so). Then I realized that desktop publishing was in fact a necessary (although not sufficient) step toward electronic publication and I started thinking hard about the future and devoted a part of my talk to it. Several editors and publishers of major journals in astronomy who were present at the meeting shared their views, and discovered that some of them were already engaged in experiments relevant to electronic publishing. After the meeting, we had no difficulty to convince the newly-born European Astronomical Society (EAS) that it was necessary to start an immediate action in Europe. We are presently forming a small group of reflection with the purpose of posing the problems, of discussing them with the astronomical com-

munity, and ultimately of recommending actions to the journals. We will have a discussion on the point at the Liège meeting of the EAS on June 22–24, 1992. All this will be made in coordination with the American Astronomical Society (AAS) which is already very active.

Publication and dissemination of their results are certainly amongst the major centres of interest of astronomers, and of scientists in general. This is why I consider that they must start thinking now about electronic publication and discussing the related problems between them, with the librarians and with other people. The present paper is a simple introduction. For more details, one should refer to the proceedings of the Strasbourg Colloquium "Desk-Top Publishing in Astronomy and Space Sciences", ed A. Heck, World Scientific, Singapore, to be published in March 1992 (of course a good deal of what I will say now is extracted from my review at this colloquium). Another good reading is the special issue of September 1991 of *Scientific American* on Communications, Computers and Networks, a subject central to electronic publication.

The Present Situation

The present situation with journal publication in astronomy can be summarized as follows:

- All journals are published on paper and distributed by normal mail.
- Microfiche or microfilm editions of some journals (*Astrophysical Journal* and its Supplement Series, *Astronomical Journal*) are also distributed. Microfiches are also sometimes used (mainly by *Monthly Notices of the Royal Astronomical Society* and by *Astronomy and Astrophysics Supplement Series*) for presenting large amounts of data. These supports, although relatively inexpensive, are not particularly favoured by the authors and the users, and their long-term behaviour is uncertain.
- Large data bases submitted to *Astronomy and Astrophysics* (A&A) are often written on magnetic tape and deposited at the Centre de Données de Strasbourg which distributes them on request: in this case the corresponding paper contains only the text and a sample of the table(s). Other sets of data are distributed on tape or on other digital

supports with or without reference to a journal, i.e. with or without refereeing.

– Camera-ready papers are accepted by many journals: for example all the Letters to A&A are produced camera-ready. Also, camera-ready tables are often inserted in typeset papers. The cost is low and the publication can be fast, but the Editors and the Publishers have no *a posteriori* control on the product which may look inhomogeneous.

– Papers prepared in electronic form by the authors are increasingly accepted by astronomy journals. Bypassing the typesetting stage is obviously the goal of most journals, which recommend the authors to send their manuscripts in digital form, either on some kind of digital support or via electronic mail. A text with an unelaborated style can be supplied by the author and then edited at the editor's or at the publisher's office, or the author can send a text prepared using macros supplied by the journal so that it will have exactly the style and sometimes even the page setting of the journal and can feed with a minimum of interventions the printer's computer.

Most journals use the first level. For this, T_EX (and L^AT_EX) has become a standard for astronomy journal publications, because of its permanence, independence on hardware and possibility of e-mail transmission. A&A, its Supplements and a few other journals use the second level. Macros are supplied to the author based on T_EX or L^AT_EX with which he prepares his text. In the case of A&A (Main Journal), the author also receives a simulation of the fonts used at the printer's plant. In this level, more work is required from the author. Moreover, page setting will always be better done by professionals, and at present has often to be redone by Springer-Verlag: this may not be the best solution for the future. In spite of this, the experiment is a success: about 30% of the papers in *A&A Main Journal* are produced by the author using the publisher's macro packages, and the increase has been very fast. A&A is the most advanced astronomy journal in this respect. However the situation is rapidly evolving and within one or two years most journals will take papers prepared in one of the two levels of electronic form.

It should be realized that astronomers are somewhat more advanced in the



use of desktop publication than the bulk of their scientific colleagues, with the noticeable exception of mathematicians who currently use T_EX to prepare papers camera-ready or on diskette. Also, astronomers are more advanced than most other scientist in the use of electronic mail for communication between them or even for sending drafts or finished papers in ASCII or T_EX. Astronomers form a well-united, relatively small community. For all these reasons, they will probably be amongst the first to turn to pure electronic publication (not really the first! I recently heard about a purely electronic journal launched by the American Association for the Advancement of Science).

Astronomy Journals on Paper?

It is clear to everyone that journals on paper have considerable inconveniences:

- They are expensive.
- They take room on our shelves; rather than money, this seems to be the reason for the continuous decrease in the number of individual subscriptions to all the major astronomy journals.
- Only a relatively small part of the information is usefull to an individual astronomer. This drawback could be avoided by multiplying the journals which would then be more specialized, or by distributing to individuals only extracts (sections) of the present journals. Multiplication of journals is certainly not the way to go. As to distribution of sections of journals only, it would certainly limit the room taken by scientific literature, but would induce a regrettable further specialization of scientists.
- Information retrieval is difficult. At present, the only practical way to retrieve information is through the indexes, which are quite limited. It is possible to retrieve the bibliography on an individual object by interrogating the SIMBAD data base, but this information has had to be introduced manually into SIMBAD through painful systematic eye searches in all the published papers!

However, paper journals have also definite advantages:

- For the moment, I consider them as the only possible support for long-term archiving. Constant (and unavoidable) changes in computer standards are such that there is nothing like an acknowledged *permanent* digital support of information for archiving. Think for example of what would have happened if we had archived the journals twenty years ago on punched cards, or ten years ago on 1600 bpi magnetic tapes that no one is able to read at present! It is certainly possible to update the digital supports in order to maintain the jour-

nals data base, but this requires strong organization and money.

- Authors like to see themselves in print! This is obviously linked to the magic of writing, but also to the previous point: authors fear that their work may not survive if on other supports.

– Paper journals provide immediate access to good-quality information: the eye is a fantastic two-dimensional scanning device.

- Browsing through paper journals allows to discover things outside our immediate field of research (the next paper is often more interesting): this is capital to avoid excessive specialization and to fertilize your own research with serendipitous, unexpected material.

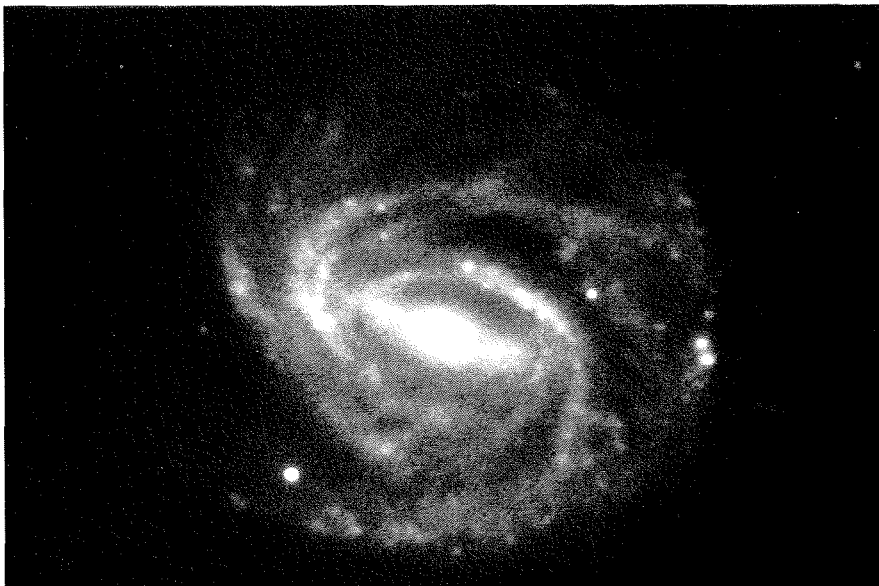
However, it is clear that in spite of

these advantages paper publication is not the way of the future: we have to face seriously electronic publication. Before going into some detail about the possibilities, it is interesting to give general guidelines.

- The main purpose of scientific journals is to archive the results of research in the best possible way, and to give the easiest possible access to this information. The refereeing system is the best we have found to insure quality and it should be kept whatever the way the journals are produced. Unrefereed preprints are circulating and will always circulate, yet they are very unevenly distributed, their quality is not guaranteed and they are unsuitable for archiving.

- I strongly believe that a printed ver-

Supernova Discovered at ESO



This photo shows the newly discovered Supernova 1992C in the barred spiral galaxy NGC 3367. The supernova is the bright, star-like object in the lower left area (southeast of the centre of the galaxy), at the tip of a spiral arm. Most of the other point-like objects are interstellar nebulae in this galaxy, whose distance is estimated at about 60 Mpc (200 million light-years).

The 16.5-magnitude supernova was discovered by ESO astronomer Hans van Winckel on January 28, 1992. He found it on a photographic plate obtained by Guido Pizarro during a search programme carried out with the ESO 1-metre Schmidt telescope at La Silla. The present photo was reproduced from a 1-minute CCD exposure in visual light obtained by Massimo Della Valle and van Winckel on January 30, 1992, with the ESO/MPI 2.2-metre telescope at La Silla.

Spectra of the supernova, obtained by Della Valle and Christopher Waelkens (Astronomical Institute of Leuven, Belgium), also with the 2.2-metre telescope, show it to be of type II and that the explosion must have happened between 10 and 20 days earlier. This means that it probably was a relatively young, heavy star that exploded. The expansion velocity was measured at about 7000 km/sec.

SN 1992C is the third supernova to be discovered in 1992. Another supernova (1986A) was found on February 4, 1986 in this galaxy, near the condensations in the spiral arms immediately above (north of) the present supernova and to the left (east) of the centre of the galaxy.

The photo covers a sky area of 156×106 arcseconds; north is up and east to the left.

sion will remain necessary for many years, at least in the main libraries. As such a version is expensive to produce, no substantial cost savings are to be expected for the moment. Even if a digital support is ultimately chosen for archiving, permanent update and maintenance of the archive will be necessary and will be costly.

– Electronic publication should be oriented towards an optimization of information retrieval: this retrieval must be as easy and rapid as possible. In particular, access to interesting papers must be immediate, including drawings and half-tones. NASA is starting a programme named STELAR (for Study of Electronic Literature for Astronomical Research) in which they will scan and put on digital form the years 1986–1990 of the AAS publications, and hopefully of European journals as well, and let a group of voluntary astronomers make experiments in information retrieval using commercial or their own software packages. This programme, that our study group will watch closely, will certainly be determinant for the future of electronic publication.

There are two types of possibilities for electronic journals:

- journals accessible via computer networks (“e-mail journals”);
- journals distributed on some individual digital support.

E-Mail Journals

The fast development of communication networks makes this solution very attractive. Technically it is fully possible at present for text and drawings, although the transmission of half-tones is still problematic and rather slow for the general customer. Reading an e-mail journal requires on-line decoding e.g. of a text produced in $T_{\text{E}}\text{X}$ (the obvious standard at least in the immediate future), and of the figures for which a standard remains to be established. For the moment, these operations are slow and cumbersome, especially for figures, but this will certainly improve fast. It is likely that at least for some time the scientist interested in a paper will first print it out. This will be costly, but it may be that ultimately we will be so well acquainted with electronic displays (of high quality, I presume) that this stage can be skipped.

I cannot foresee any problem with the refereeing procedure: all the exchange between author, editor and referee involving paper can be made electronically. However, difficult problems with copyright and recovery of publication costs should be addressed amongst others. One problem that will probably remain for a rather long time is the inter-

mittent difficulty of access due to network and computer crowding. Also, you will not be able for some time to consult your favorite journal in the train or in the plane, unless you have in advance printed or copied on an individual digital support the papers you are interested in. Finally, this solution is unfair to developing countries or isolated places that are still outside the main communication networks; but this will not last for long, probably.

Journals Distributed on Individual Digital Support

In principle this solution avoids most of the problems just discussed with e-mail publication. However, it has its own problems, which are so severe that I have the feeling that it will not make it for the future. For example, it requires that you have on your personal computer a sophisticated reading software and also a screen good enough for a nice

VACANCIES ON LA SILLA

STAFF ASTRONOMER

A position of staff astronomer will become available on La Silla in the second half of 1992. This position is open to experienced astronomers with a Ph.D. degree or equivalent and several years of post-doctoral experience in the area of infrared imaging and/or spectroscopy using array detectors.

The successful applicant will integrate the IR group on La Silla and will share the responsibility of operating the infrared cameras and the infrared spectrograph (IRSPEC). This includes:

- introducing visitors to the use of the equipment,
- writing and updating User's Manuals,
- developing and upgrading data-reduction packages,
- regularly testing the performance of the equipment, and
- interacting with the technical staff regarding modifications and updates of the instrumentation and the control software.

As members of the Astronomy Support Department on La Silla, staff astronomers are required to spend at least 50% of their time on support activities and the remainder conducting original research and participating in academic activities. The Astronomy Group on La Silla is composed of about 20 astronomers including staff, post-doctoral fellows and research students.

Staff posts are tenure track positions, normally offered for an initial period of 3 years that may be renewed for a second period of 3 years. Tenure may be granted during the second term of the staff contract.

The successful applicant will have an excellent opportunity of participating in the commissioning phases of the VLT.

Applications should be submitted to ESO Personnel Administration and General Services at ESO-Garching **before 31 May 1992**.

FELLOWSHIP

A post-doctoral fellowship is offered on La Silla starting during the second half of 1992. This position is opened to a young astronomer with an interest in stellar photometry. Experience in CCD photometry in crowded field will be an advantage. The ESO fellowships are granted for a period of one year, normally renewed for a second and exceptionally for a third year.

The successful applicant will be required to spend 50% of his/her time doing support activities and 50% of the time on research.

Applicants normally should have a doctorate awarded in recent years. Applications should be submitted to ESO **not later than 15 May 1992**. Applicants will be notified by June 1992. The ESO Fellowship Application Form should be used and be accompanied by a list of publications. In addition, three letters of recommendation should be obtained from persons familiar with the scientific work of the applicant. These letters should reach ESO **not later than 15 May 1992**.

The research interests of the members of the staff in the Astronomy Support Department include low-mass star formation, formation and evolution of massive stars and starbursts, post-AGB stellar evolution and planetary nebulae, supernovae, active nuclei, high redshift galaxies and galaxy clusters. Staff members and senior fellows act as co-supervisors for students of European universities that spend up to 2 years on La Silla working towards a doctoral dissertation.

Enquiries, requests for application forms and applications should be addressed to:
European Southern Observatory
Fellowship Programme
Karl-Schwarzschild-Straße 2
D-8046 Garching b. München
Germany

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_{pap} is the number of papers, N_{ack} the number of acknowledgements.

	ApJ	ApJS	A&A	A&AS	MNRAS	AJ	Nat	Total
N _{pap}	1635	90	977	169	544	368	102	3885
N _{ack}	5203	393	2377	419	1282	1388	313	11375
N _{ack} /N _{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 Astrophy-*

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

Name	Affiliation	ApJ	ApJS	A&A	A&AS	MNRAS	AJ	Nat	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
J. P. Huchra	Harvard-Smithsonian Center for Astrophysics, Cambridge, USA	4	3	2	1	4	4	2	20
R. 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