

# The Impact of Electronic Publishing on the Academic Community

## Session 3: The content and quality of academic communication

### A blueprint for electronic publishing in physics

J.C. Sens

Division PPE, CERN, CH-1211 Geneva 23, Switzerland, and \*Institut Non-Linéaire de Nice, Université de Nice, Sophia Antipolis, 1361 Route des Lucioles, 06560 Valbonne, France

\*Address for correspondence.

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### New standards for the communication and conservation of research results

Much has been said in recent years about the inadequacy of the current system of reporting and conserving the results of scientific research. There is no time, and no need, to go over these arguments again: the simple observation that average journal prices have increased by 150% since 1985, while the number of printed pages of some primary journals is doubling every six years (e.g. see [1]), adequately summarizes the current status.

There is much less consensus as to the solution to these problems. It is my contention that whatever the solution, it must be in accord with the following observations. (i) In the current research environment, reporting and preserving research results is part and parcel of the research project itself. There is no ground for a team of four to five physicists to spend \$5000 on constructing equipment, or for a team of 400--500 physicists to spend \$500 million on building a large-scale detector, to work for several years on measurements and analysis, to travel the road from logbook to article, the project's only tangible result, and then pass the product to the commercial world, from where its dissemination is governed by entirely non-scientific considerations, and effectively limited by the fee structures of electronic and paper journals.

(ii) Research must lead to basic reporting and archiving, i.e. to storage on physically interlinked databases in standard format forming logically a single database, accessible now and 100 years from now, equipped with search tools and keywords, referring to the intrinsic characteristics of the material (sub-fields, etc.), and not to names of journals, publishers, etc.

(iii) The 'secondary' literature is not subject to these requirements, and continues to generate revenue for publishers by its generally wide-spread dissemination to a larger public.

(iv) Whatever the solution, it must follow the same standards everywhere, not just on the North American continent and in Europe. It must contribute to the elimination of the notions of 'underdeveloped', 'developing' and 'developed' countries.

(v) It must restore the quality of library services.

(vi) Whatever the solution, it must cost substantially less than the sum-total of the subscription fees of the current primary journals.

Physicists are organized in physical societies, and the societies are bundled in the International Union of Pure and Applied Physics (IUPAP). (Details can be found on the Web site, <http://www.physics.umanitoba.ca/IUPAP/>). The IUPAP Working Group on Communications in Physics is currently examining a new system of communications which would be compatible with these prerequisites.

In this system the submission, archiving and retrieval procedures of the primary research material would become the responsibility of the physical societies. Anyone, anywhere, would obtain access to the entire physics literature.

For the publishers, this shift towards the societies as the central agents implies a change of strategy in three respects: (i) publishers would have access to the databases, and be allowed to publish copies of the primary material, for which in practice there will be a very small market; (ii) publishers would continue to publish refereed review-style journals, as well as 'secondary' journals, based on material drawn from the databases; and (iii) publishers may wish to make their expertise available and participate in the tedious business of the daily translation of incoming manuscripts into standard format.

Concerning the societies, for practical reasons one could use the existing structure of 'Regional Physical Societies'. A 'World Physical Society' does not exist and would be unbalanced; the national societies, on the other hand, are too numerous and would raise the cost by an order of magnitude. A consortium of six (see below) Regional Physical Societies would seem to be a reasonable compromise.

One could classify the submission process as follows: the existing Regional Physical Societies create 'regional publishing offices' (RPOs). Each RPO creates and manages a full-text database. Authors in all fields of physics send their manuscripts to these databases. The original manuscript is called 'e-print' (electronic print). E-prints intended for 'conservation', i.e. for long-term storage, are translated into standard format in order to guarantee permanent accessibility.

Translated e-prints are then subjected to a 'certification' process by editors and referees. Certified, translated e-prints are called 'articles'. 'Articles', i.e translated and 'certified' e-prints, intended for publication in journals (in their original form, or as elements of review and summary articles) are passed on to the relevant publisher for (optional) re-editing, (paper and/or electronic) printing and distribution. Articles accepted for publication in journals are flagged as 'publications' and remain accessible on the RPO databases.

## **The Regional Physical Societies**

Such an organization requires a high degree of discipline, a strict adherence to standards for the conversion of manuscripts into a unique format, independent of time and geographical location, standards for access by readers, a section for software development, a section for finances, a staff of editors and referees in all sub-fields of physics, etc.

A major question, to which there is no answer at this time, is whether the existing Regional Physical Societies are capable of undertaking these tasks, either by themselves or by partly sub-contracting the work to outside firms, and, if not, what must be done to make them operational in the near future.

Here I only list the six Regional Physical Societies as they exist today [2]. The European Physical Society (EPS) is the regional society for 36 member societies in Europe. In the U.S.A., the American Institute of Physics (AIP) is not a regional society in the geographical sense, but a conglomerate of 10 professional societies, i.e. the American Physical Society (APS), the Acoustical Society of America, etc., representing a total of 120\000 members. AIP publishes 14 journals, while some of the member societies publish journals in their own specialities, e.g. *Physical Review (A,B,C,D and E)* and *Physical Review Letters*, published by APS.

This centralization of publication activities, along with the activities at Los Alamos, where a fast-growing collection of preprints in different sub-fields is available to any interested reader, constitutes in effect the basic ingredients for the U.S.A. of the proposal under discussion.

In south-east Asia, the Association of Asian Pacific Physical Societies (AAPPS) has 17 member Societies. A characteristic feature here is the very large difference in the status of physics research in the various member countries. The Euro-Asian Physical Society (EAPS) is the regional society comprising five societies of the former Soviet Union, with approximately 5\000 members. The Federation of Latin-American Physical Societies (FELASOFI) is the regional society of 17 physical societies in Central and South America and represents approximately 15\000 physicists. The Society of African Physicists and Mathematicians (SAPAM) is the regional society for Africa, with 950 members.

## **Submission and archiving procedures**

If the RPOs someday become a reality, one may imagine how they would function.

## **Databases**

The databases contain three types of file: E-prints; 'articles', i.e. translated and 'certified' (edited and refereed) e-prints; and 'publications', i.e. 'articles' which have been published, or are to be published, in journals.

## **E-prints**

Manuscripts are written in any electronic format. Prior knowledge of SGML (standard generalized markup language), HTML (hypertext markup language), etc. is not required. Manuscripts are stored in their original format as well as in PostScript format. They are then called 'e-prints'. Access to e-prints is generated by means of a Web interface, extracting information such as abstracts, titles, authors and keywords. The full text (in any format) is accessible for queries or to copy.

This bulletin board type service is available by subscription, e.g. 'subscribe user to e-prints of author X , or institute Y, or on topic Z'. This service is free of charge.

## **E-prints intended for 'conservation': 'articles'**

The author informs the RPO via e-mail of his intention to submit his manuscript, currently stored as an e-print on the database, to the appropriate RPO editor and referees for 'certification'. The RPO translates the e-print to the 'standard format for physics articles' as defined by the International Standard Organization, see [3]. This standard is worldwide, i.e. the same for all regions.

The RPO editor contacts one or more referees via e-mail. The referee gets access to the translated e-print. Modifications are inserted in standard format and returned to the database. Finally, the editor notifies the author that the translated e-print has been, or has not been, 'certified'. If certified, the translated e-print becomes an 'article'; if not, it remains a translated e-print. The original (untranslated) e-print may be deleted from the database. The 'article' is flagged, archived and remains accessible to interested readers for viewing and copying via the Web.

## **Articles intended for publication: 'publications'**

Only 'articles', i.e. certified e-prints in standard format can qualify for publication. Authors indicate their agreement to have their article published by the appropriate publisher. The publisher copies the article in standard format from the RPO database to the publisher's private database. The conversion to camera-ready copy, the paper (and/or electronic) printing and the distribution is the responsibility of the publisher. The published article ('publication') remains on the RPO database and is accessible to interested readers via the Web, for a fee.

## **Features of the proposed re-organization**

It introduces a full-scale, one-step automation of the communication and conservation process of electronically produced manuscripts, applicable worldwide and to all branches of physics.

It puts the physical societies where they belong, i.e. at the centre of the world of communications of primary scientific results.

The entire primary physics literature is stored on what is logically a single database albeit physically distributed.

The motivation for a regional, instead of a national or single worldwide form of organization stems from the need to distribute the work, and from the need for geographical proximity, command of languages, etc. in the interactions between the publication offices and the authors. (IUPAP has 47 member nations, while there are six regional societies).

Private companies continue to play a major role in the business of electronic publishing, with increased efficiency and reduced cost, by continuing to issue their own review, semi-popular and popular journals and/or by taking on the translation of manuscripts to standard format under contract with the RPOs.

All publishers of all journals receive the articles in the same vendor- and time-independent format. The smaller publishers do not need to invest in costly in-house conversion efforts. The (larger) publishers currently accepting electronic manuscripts can discontinue their in-house conversion efforts and make their expertise available to the RPOs. Much duplication among the larger publishers is thus eliminated. Re-keying and re-processing of manuscripts by the publishers becomes a thing of the past.

The proposed re-organization permits public-plus-anonymous peer review of all e-prints, and public-plus-anonymous peer review of the articles submitted for publication. The combined public-plus-anonymous peer review is a novel feature of the proposed re-organization. Public peer review will generate expert opinions from unexpected places and will thus assist in improving the quality of the articles on the database and the publications [4].

The proposed re-organization will provide a single platform for discussions and dialogue between the different regional physical societies on matters of electronic publishing.

## **Funding issues**

The RPOs would be non-profit organizations. The RPOs should be self-financing, have a balanced budget and be accountable to the Regional Physical Societies. They require an initial investment and an annual budget, mainly to pay salaries of the RPO staff. The number of staff posts will depend on the workload, contracts with outside firms, etc.

Funding for initial investments may come from sources such as the United Nations Educational, Scientific and Cultural Organisation (UNESCO), the International Council of Scientific Unions (ICSU), the European Union, national academies and physical societies. One source of income for the annual budget needed to cover the cost of converting manuscripts to archived articles might be the funding agencies of libraries, by a re-allocation of funds being used to pay the subscriptions to paper journals. A second source of income would be the charges to be paid by publishers for the transfer of certified manuscripts in standard format to the publisher's database.

A third source of income would come from charges paid by readers wishing to copy 'publications' using a printer in their home institute. This payment is made via a credit card (individual or institutional) or by subscription. For each copy a royalty is paid by the RPO to the publisher of the article in question. For e-prints, access to the regional databases is free of charge.

## Summary

The IUPAP proposal invites the six Regional Physical Societies, EPS, AIP, AAPPS, EAPS, FELASOFI and SAPAM, to create 'Regional Publishing Offices', providing author/reader services such as: a complete archive of the primary physics literature; a full-text consultation service; reader intervention via annotation of e-prints; standard tools for access by editors and referees; delivery to publishers in standard format; and a bulletin-board service.

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## Notes and references

1. Sens, J. C. (1996) Electronic Publishing via Scientific Societies. In *Proceedings of the Joint ICSU PRESS/UNESCO Expert Conference*, (D. Shaw and H. Moore, eds.), p.162
2. Directory of Physical Societies 1995, RACIP2 Conference, Tokyo
3. Published by the International Organization for Standardization (ISO). Currently, this standard is ISO 8879 (SGML, 1986) and ISO 12083 (Electronic manuscript preparation and markup, 1994). Developments are underway at Microsoft, SUN, etc. on 'XML', an upgraded version of SGML, which would replace HTML, improve the handling of mathematics and be better adapted to the Internet.
4. A striking illustration of the benefits of open peer-review was made by P. Ginsparg in an e-mail message of 3 May 1997 by quoting an observation made by B. Nodland and J.P. Ralston on a rotation of the plane of polarization of photons propagating over cosmological distances; this observation generated three responses within a matter of days.

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