

A sustainable business model for Open-Access journal publishing: a proposed plan for High-Energy Physics

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ABSTRACT

The High Energy Physics community over the last 15 years has achieved so-called full green Open Access through the wide dissemination of preprints via arXiv, a central subject repository managed by Cornell University. However, green Open Access does not alleviate the economic difficulties of libraries as they are still expected to offer access to versions of record of the peer-reviewed literature. For this reason the particle physics community is now addressing the issue of gold Open Access by converting a set of the existing core journals to Open Access. A Working Party has been established to bring together funding agencies, laboratories and libraries into a single consortium, called SCOAP³ (Sponsoring Consortium for Open Access Publishing in Particle Physics). This consortium will engage with publishers to build a sustainable model for Open Access publishing. In this model, subscription fees from multiple institutions are replaced by contracts with publishers of Open Access journals, where the SCOAP³ consortium is a single financial partner.

BACKGROUND

The goal of Open Access (OA) is to grant anyone, anywhere and anytime, free access to the results of scientific research. The OA debate has gained considerable momentum in recent years. It is driven mostly by two factors:

- The 'serials crisis' of ever-rising costs of journals, which has forced libraries to cancel a steadily-increasing number of subscriptions, curtailing the access of researchers to important scientific literature.
- The increasing awareness that results of publicly-funded research should be made generally available. This need is amplified by the transformation of research activities towards 'e-Science', carried out by a global scientific community linked by strong networks

In December 2005 a tripartite Task Force, comprising funding agencies, publishers and research organizations, was set up to study the possibilities for OA publishing in High Energy Physics (HEP). Its main conclusion was that a model whereby the costs of publishing were paid globally, rather than on an article-by-article basis, was the most appropriate for a new publishing model. It is interesting to observe that in recent years, all physics publishers have introduced Open Access options of one kind or another, clearly all moves that can be directly linked to the ongoing vivid debate in the community itself.

However in spite of the fact that 90% of the articles published today could in principle have been published as OA, only a very small fraction of authors - due to the fact that no funding mechanisms have so far been put in place to cover the corresponding publication fees - actually have the opportunity to choose this option. On the other hand, there is no doubt that the community is motivated to communicate its scientific findings via OA; actually HEP pioneered the OA route before internet facilitated information exchange as we know it today. For decades physicists actually shipped manuscripts intended for publication in hundreds of copies, in the jargon referred to as preprints, to colleagues around the world for comment prior to publication. Librarians at CERN then came up with the idea of compiling a catalogue of these documents, a collection of papers that after all proved itself to be the backbone of communication within the community. This catalogue later turned into a database and eventually into a so-called 'repository' containing collections of 'pre-prints' freely accessible on internet. Today the main bulk of HEP pre-prints are available through repositories and the papers can easily be retrieved via services offered by [arXiv](#), the [CERN Document Server \(CDS\)](#) or the [SPIRES database](#). Thanks to the speed with which they make results available, repositories have re-enforced the role of preprints as the lifeblood of HEP scientific information exchange. This is what the OA movement often refers to as green OA. However, repositories do not perform peer review and may contain only the original versions of articles *submitted* to journals, and not necessarily the final, peer-reviewed, *published* versions.

Notwithstanding the success of repositories, there is consensus in the scientific community about the need for high-quality journals that will continue to provide:

- quality control through the peer review process
- a platform for the evaluation of, and career evolution for, scientists
- a measure of the quality and productivity of research groups and institutes

Making this class of papers available to anyone, anywhere and anytime brings us to what is referred to as gold OA.

The price of an electronic journal is mainly driven by the costs of running the peer-review system and editorial processing. Most publishers quote a price in the range of 1,000–2,000 euros per published article. On this basis we estimate that the annual budget for the transition of HEP publishing to OA would amount to a maximum of 10 million euros per year. In comparison, the annual list-price of a single ‘core’ HEP journal today can be as high as 10,000 euros; for 500 institutes worldwide actively involved in HEP, this represents an annual expenditure of 5 million euros.

THE SCOAP³ MODEL

The proposed initiative aims to convert high-quality HEP journals to OA, pursuing two goals:

- to provide open and unrestricted access to all HEP research literature in its final, peer-reviewed form;
- to contain the overall cost of journal publishing by increasing competition whilst assuring sustainability.

In this new model, the publishers’ subscription income from multiple institutions is replaced by income from a single financial partner, the Sponsoring Consortium for Open Access Publishing in Particle Physics ([SCOAP³](#)). SCOAP³ is a global network of HEP funding agencies, research laboratories, and libraries. Each SCOAP³ partner will recover its contribution from the cancellation of its current journal subscriptions. This model avoids the obvious disadvantage of OA models in which authors are directly charged for the OA publication of their articles.

FINANCING

The financing and governance of SCOAP³ will follow as much as possible the example of large research collaborations and each country will contribute according to the number of its scientific publications, as presented in the Figure below. To cover publications by scientists from countries that cannot reasonably be expected to contribute to the consortium at this time, an allowance of not more than 10% of the SCOAP³ budget is foreseen.

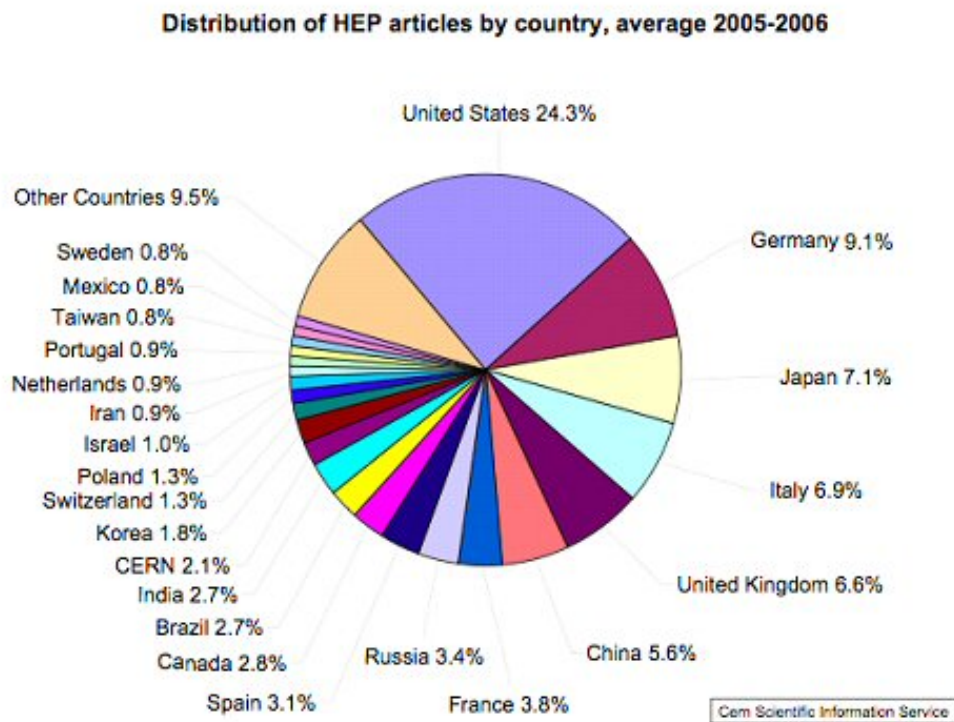


Figure 1: Contributions by country to the HEP scientific literature published in journals spotlighted for conversion to OA. Co-authorship is taken into account on a pro-rata basis, assigning fractions of each article to the countries in which the authors are affiliated. This study is based on all articles published in the years 2005 and 2006 in the five HEP “core” journals: *Physical Review D*, *Physics Letters B*, *Nuclear Physics B*, *Journal of High Energy Physics* and the *European Physical Journal C*, and the HEP articles published in two “broadband” journals *Physical Review Letters* and *Nuclear Instruments and Methods in Physics Research A*, tagged as described in Section 3. A total sample of almost 11,300 articles is considered. Countries with individual contributions of less than 0.8% are aggregated in the “Other countries” category. (From: [Krause, Lindqvist & Mele, 2007](#)).

In practice, transition to OA will be facilitated by the fact that the large majority of HEP articles is published in just six peer-reviewed journals from four publishers. Five of these six journals carry a majority of HEP content. These are:

- *Physical Review D* (American Physical Society)
- *Physics Letters B* and *Nuclear Physics B* (Elsevier)
- *Journal of High Energy Physics* (SISSA/IOP)
- *European Physical Journal C* (Springer)

The aim of the SCOAP³ model is to assist publishers to convert these ‘core’ HEP journals entirely to OA and it is expected that the vast majority of the SCOAP³ budget will be spent to achieve this target. The sixth journal, *Physical Review Letters* (American Physical Society), is a ‘broadband’ journal that carries only a small fraction (10%) of HEP content; it is the aim of SCOAP³ to sponsor the conversion of this remaining content to OA. The same approach can be extended to another ‘broadband’ journal popular with HEP instrumentation physicists: *Nuclear Instruments and Methods in Physics Research A* (Elsevier) with about 25% HEP content. The schema will of course not be limited to the titles listed above; all publishers will be welcome to bid to be included. For new journals, criteria such as the profile of the editorial board or the size of the author and reader base will be considered.

HEP has a natural overlap with related fields such as, but not limited to, astro-particle physics and nuclear physics. The five 'core' journals include between 10% and 30% of articles in these disciplines, which will naturally and logically be included in the OA transition. This is in the interest of the readership and promotes the long-term goal of an extension of the SCOAP³ model to these related disciplines. The 'broadband' journals quoted above also include publications in these related disciplines. Of course, the SCOAP³ model is open to any other, present or future, high-quality journals carrying HEP content. This will ensure a dynamic market with healthy competition and a broader choice.

The annual budget for the SCOAP³ operation will be established through a tendering procedure. The tender and the subsequent contracts with publishers will address the use of OA articles, the conditions for unbundling OA journals from existing subscription packages, and the reduction of subscription prices for 'broadband' journals following the conversion of a fraction of articles to OA. Provided that the SCOAP³ funding partners are ready to engage in long-term commitments, many publishers are expected to be ready to enter into negotiations along the lines proposed here.

ROLES OF AND BENEFITS FOR LIBRARIES

Most scientific libraries are currently federated into consortia, primarily on a national or regional basis, and their actions are often linked to the main territorial funding agencies, e.g. Consortium Universitaire de Périodiques Numériques ([COUPERIN](#)) in France, grouping some 200 libraries and maintaining strong links to Centre National de Recherche Scientifique ([CNRS](#)), Institut National de la Santé et de la Recherche Médicale ([INSERM](#)) and Institut National de la Recherche Agronomique ([INRA](#)). In Germany the consortia are organized at the level of the Länder; in Belgium they are organised separately for the two main linguistic communities. In the present system, these consortia negotiate with publishers; they also pool their budgets in paying access fees for electronic collections. These national and regional library consortia are considered as natural candidates for participation in SCOAP³.

In the OA era, libraries will continue to serve the scientific community by providing access to the entire, multi-disciplinary, scientific literature including the HEP articles to be published in OA journals. How the libraries will be involved financially regarding OA publishing will obviously vary from country to country, depending on the specific financial model chosen. Some countries might transfer parts of current subscription budgets to the research sector, earmarked for publication costs, while other countries might choose to ask their universities to pay publication costs *pro rata* for their affiliated authors via their libraries.

The transition to OA will allow libraries to start moving away from the current situation which is actually nothing but an electronic clone of the paper era. New services integrating text and data, a concept often referred to as e-Science, will be built on analysis of entire bodies of text within a specific domain, or even across subject fields, and open the possibility for a range of community-based systems. A few examples of such services, not even considering the potential for bringing data together with texts, are: automatic selection of all articles of interest to the viewer of a given article, through a combined study of what previous users have read, citation analysis, author networks; automatic detection of the subject of an article from full-text mining and citation analysis; and a system of citation metrics aimed at tagging influential, prestigious and popular articles, in order to complement the journal 'impact factor' currently used to evaluate the productivity of institutions and individuals according to the journals in which they publish. These types of developments can clearly not take place as long as the main bulk of published text is subject to subscription with strict restrictions for how the material can be used. In addition, the library community will play a fundamental role in the long-term archiving of the OA articles.

ROLES OF AND BENEFITS FOR PUBLISHERS

In the SCOAP³ model, publishers will continue to have the primary responsibility of ensuring the highest standards of quality for the published articles through independent editorial boards and peer review. They will ensure the dissemination of OA articles by posting them on their web sites, without any access barrier, and by feeding them to a SCOAP³ repository.

Publishers will benefit from a more sustainable business model than in the traditional subscription schema, which is becoming increasingly fragile. Furthermore, they will continue to meet the demands from libraries,

research collaborations or any other potential group of users and charge these groups individually for ‘premium’ services and products outside the scope of SCOAP³, such as:

- print subscriptions
- re-prints of single articles
- colour plates in these printed versions
- collections of articles in electronic or paper formats
- access to bibliographic databases

ROLES OF AND BENEFITS FOR FUNDING AGENCIES

The costs of scientific publication are predominantly those costs associated with the organisation of the peer-review process, which is central to science. According to the OA paradigm, these costs should be shifted from the reader community to the author community. In HEP, these two communities are largely overlapping and are funded by the same entities. Funding agencies are therefore at the pivotal point of the transition to OA in scientific publishing, and the ultimate decision and responsibility for the operation rests with them.

Funding agencies will be the key players in financing SCOAP³ both directly and indirectly, according to the systems of each country. Funds will come from the re-direction of subscriptions that are paid directly by the funding agencies, or by additional investments in the transition to OA. Funding agencies will be instrumental in engaging the national bodies paying subscriptions to publishers to re-direct those funds towards SCOAP³. They will also play a role of paramount importance in raising awareness of OA amongst their author base.

In the long run, funding agencies will profit from the savings due to the cost-effective publication strategy offered by SCOAP³. They will also benefit from a more stable and competitive publication market. Finally, they will profit from the broader visibility (under OA tenets) of the research they sponsor.

THE LIFE-CYCLE OF A SCOAP³ OA ARTICLE

The SCOAP³ transition to OA aims to be transparent for authors. The life-cycle of a SCOAP³ article may start in any country when the article is submitted to one of the high-quality journals which are partners in SCOAP³. The submission will in all cases be free of charge, since the peer-review and publication costs are supported by SCOAP³. The journals will process the article through their peer-review system. Upon acceptance, the article will immediately be published under OA on the publisher’s website. At the same time it will be sent, together with all related metadata, to a repository designated by SCOAP³. From there, mirror copies in other repositories will ensure the widest-possible dissemination and long-term preservation of the article. This population of repositories with final versions of peer-reviewed articles will become the norm within the HEP community. It will generate a new e-infrastructure for e-Science providing amongst other things:

- A freely-accessible source of data for text and data mining applications
- A comprehensive, freely-available, citation index for hep publications
- A system to measure continuously the scientific output of individual countries, which is at the basis of sharing the costs of scoap³

ACCESS TO PREVIOUSLY PUBLISHED LITERATURE

As in most sciences, research in HEP relies heavily on previously-published work. In the case of specialized journals, citations often refer to earlier articles published within the same journal or in other “core” HEP journals. Hence, it is a legitimate expectation of the reader community to have access to these earlier articles

that are contained in publishers' backfiles. SCOAP³ will address the access issue in two different ways, depending on the formats in which these backfiles are currently preserved and made available:

- some current journal subscriptions include access to a limited number of previous editions. These include typically the recently-digitised yearly collections of long-standing journals or the entire production run in the case of new (electronic) journals. For some other titles the subscriptions cover a fixed number of years within a 'moving wall'. In the SCOAP³ model, publishers will be required to provide free access to the same volume of backfiles as they presently make available in their subscription models
- some journals have recently made available digitised versions of their entire 'historic' archive including in some cases precursor titles. Access to these backfiles is possible today through annual subscriptions or through a single 'one-off' payment. In the SCOAP³ model publishers will be invited to make an offer for providing OA to these 'historic' backfiles

TIMELINE

Leading funding agencies and library consortia are currently signing an 'Expression of Interest' to provide financial backing for the consortium. Once sufficient momentum is gained, a tendering procedure will take place to determine the exact budget envelope. A 'Memorandum of Understanding' detailing the financial contribution of each country and the governance of SCOAP³ will then be signed. Finally, contracts will be established with publishers in order to make Open Access publishing in High Energy Physics a reality in 2008.

The example of SCOAP³ will be an important milestone in the history of scientific publishing. It could rapidly be followed in other disciplines and, in particular, by fields related to HEP such as nuclear physics or astro-particle physics.

POSTSCRIPTUM

The preparation for the setup of SCOAP³ was officially started following a meeting held at CERN on November 3rd 2006.¹ The actual pledging of funds started, however, only on July 1st 2007. By October 1st, only 3 months later, as much as 27% of the required funds had already been confirmed. The financial models behind the signatures are, as expected, different from country to country. In chronological order the following partners have signed the Expression of Interest:

- Germany: [Max-Planck-Gesellschaft](#) (MPG), [Helmholtz-Gemeinschaft](#) and [Deutsche Forschungsgemeinschaft](#) (DFG)
- France: Centre National de Recherche Scientifique ([CNRS](#))
- Greece: The national Rectors Conference (University Alliance)
- [CERN](#), the European Organization for Nuclear Research.
- Italy: Istituto Nazionale di Fisica Nucleare ([INFN](#))
- Cuba: Instituto de Información Científica y Tecnológica ([IDICT](#))



Photo of the Group of CERN officials

The vice-rector of the University of Patras, Professor Vassilis Anastassopoulos hands over to CERN Director-General Dr. Robert Aymar, the very first financial contribution to the emerging consortium SCOAP³ during the OAI Workshop held at CERN in April 2007. Receiving a check prior to even having asked for money was of course very stimulating for the group of CERN officials who is in charge of the fund raising process.

Photo: Ruder Bošković, Knjižnica Instituta ²

Further, a range of countries are expected to join the consortium before the end of 2007, among these are Canada, Luxembourg, Norway, Poland, Portugal and Sweden. The challenge now is to get the main partners outside of Europe on board on time for the first physics results expected when the Large Hadron Collider will circulate its first beams across the Franco-Swiss border next year. ³

REFERENCES

Krause, Jan, Carl Marten Lindqvist and Salvatore Mele: *Quantitative Study of the Geographical Distribution of the Authorship High-Energy Physics Journals*. Geneva : European Organization for Nuclear Research, July 2007. CERN-OPEN-2007-014. <http://www.scoap3.org/files/cer-002691702.pdf>

WEB SITES REFERRED TO IN THE TEXT

arXiv.org. <http://arxiv.org/>

CDS - CERN Document Server. <http://cdsweb.cern.ch/>

CNRS - Centre National de Recherche Scientifique. <http://www.cnrs.fr>

COUPERIN - Consortium Universitaire de Périodiques Numériques. <http://www.couperin.fr>

DFG - Deutsche Forschungsgemeinschaft. <http://www.dfg.de>

CERN - European Organization for Nuclear Research. <http://public.web.cern.ch/Public/Welcome.html>

Helmholtz-Gemeinschaft. <http://www.helmholtz.de>

IDICT - Instituto de Información Científica y Tecnológica. <http://www.idict.cu>

INFN - Istituto Nazionale di Fisica Nucleare <http://www.infn.it>

INRA - Institut National de la Recherche Agronomique. <http://www.inra.fr>

INSERM - Institut National de la Santé et de la Recherche Medicale. <http://www.inserm.fr>

MPG - Max-Planck-Gesellschaft. <http://www.mpg.de>

SCOAP³ - Sponsoring Consortium for Open Access Publishing in Particle Physics. <http://www.scoap3.org/>

SPIRES - High-Energy Physics Literature Database. <http://www.slac.stanford.edu/spires/>

NOTES

¹ The proceedings of the 3rd November meeting (2006) are available from <http://indico.cern.ch/conferenceDisplay.py?confId=7168>.

² More photos can be seen at: <http://internilib.irb.hr/galerija/displayimage.php?album=253&pos=22>

³ The Large Hadron Collider (LHC) is being built in a circular tunnel 27 km in circumference. The tunnel is buried around 50 to 175 m. underground. For further details, consult <http://lhc-machine-outreach.web.cern.ch/lhc-machine-outreach/>