Open Access Publishing in High-Energy Physics: the SCOAP^3 model

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Note

This manuscript was prepared in December 2007 and appeared in January 2009 in *OCLC Systems & Services*, Volume 25, Number 1, 2009 , pp. 20-34(15). Since then, the SCOAP^3 initiative has grown to count hundreds of partners in over 20 countries, collectively pledging (February 2009) over 60% of the SCOAP^3 budget envelope. This information supersedes the one presented in Section 6.

Abstract

The Open Access (OA) movement is gaining an increasing momentum: its goal is to grant anyone, anywhere and anytime free access to the results of publicly funded scientific research. The High-Energy Physics (HEP) community has pioneered OA for decades, through its widespread "pre-print culture". After almost half a century of worldwide dissemination of pre-prints, in paper first and electronically later, OA journals are becoming the natural evolution of scholarly communication in HEP. Among other OA business models, the one based on a sponsoring consortium appears as the most viable option for a transition of the HEP peer-reviewed literature to OA. The Sponsoring Consortium for Open Access Publishing in Particle Physics (SCOAP^3) is proposed as a central body to remunerate publishers for their peer-review service, effectively replacing the "reader-pays" model of traditional subscriptions with an "author-side" funding, without any direct financial burden on individual authors and research groups. Sustainable funding to SCOAP^3 would come from libraries, library consortia and HEP funding agencies through a re-direction of funds currently, and traditionally, spent for subscription to HEP journals. This article discusses the SCOAP^3 model in details, from its origins in an analysis of the HEP publishing landscape to its current implementation.

CERN-OPEN-2009-004
01/12/2007

1. INTRODUCTION

The goal of *"Open Access"* (OA) is to grant anyone, anywhere and anytime, free access to the results of scientific research [1]. The OA debate has gained considerable momentum in recent years across many disciplines, both in sciences and humanities. All actors of scholarly communication: libraries, funding agencies, scholars and publishers are deeply involved in this discussion, driven by two factors.

- The ever-rising costs of journals have forced libraries to cancel a steadily increasing number of subscriptions, curtailing the access of researchers to scientific literature, up to the paradox that some institutions cannot afford any longer purchasing the journals in which their scientists publish. This traditional business model has therefore become financially unsustainable for libraries and publishers alike.
- The increasing awareness that results of publicly funded research should be made generally available; a need inspired by the multiplication and diversification of communication channels in the new technological environment, further amplified by the ongoing transformation of research activities towards "e-Science".

This situation is particularly acute, among other fields, in High-Energy Physics (HEP), a community living a particular conundrum in its scholarly communication practices. On one hand, it has taken a pioneering stance since decades for the open diffusion of its results, well beyond the role of journals, through its long-lasting "pre-print culture" discussed in the following; on the other hand its researchers, like scholars across all other disciplines, need high-quality peer-reviewed journals to provide them with [2]:

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

The story of OA in HEP is several decades old. Half a century ago, long before the time of electronic journals, the delay between the submission of a scientific article to a journal and when it would reach the reader appeared unacceptable to HEP scientists, which therefore embraced pre-prints as their main mean of communication [3], leading to the flourishing of the "pre-print culture". One of the reasons behind this choice was the peculiarity of the HEP community, with two constantly interacting driving forces: experimental physicists on one side, working at particle accelerators of ever-increasing energies, with – literally – one discovery per week in those early days, and theoretical physicists on the other side, continuously interpreting these new findings, constantly refining their theories and suggesting new experimental studies to gain more insight into the inner workings of the early universe. Several months of delay in their communications would have been a severe handicap to the advancement of the field. These needs were amplified by a thriving tradition of cross-border collaboration and a geographically spread community.

It is interesting to note that the expenses of printing and mailing this massive amount of pre-prints were borne by the author's institutions: an *ante litteram* version of "author pays" OA models, which clearly privileged researchers working at wealthy institutions. These institutions were also more likely to *receive* pre-prints, restraining broad communication to the privileged, and thereby unbalancing the scientific communication process worldwide.

With the onset of the Internet, the HEP community spearheaded the culture of "repositories": online collections of freely accessible pre-prints, with the arXiv system [4], invented by Paul Ginsparg then at the Los Alamos laboratories [5]. This system is today the archetypal repository, and saw the light even before the web was invented. Come to the web, while it is universally known that the web was born at CERN, for the need of organising information management in the largest HEP laboratory, it is remarkable that the first web server on US soil was that of the SPIRES system [6,7]. SPIRES is an e-catalogue of HEP publications and pre-prints run at the SLAC HEP laboratory at Stanford since 1974. In 1991 it embraced the web with the vision of enabling users to browse pre-prints more efficiently [7].

Thanks to the speed at which they make results available, pre-prints first and repositories later have become the lifeblood of HEP scientific information exchange. However, repositories usually contain the original version of articles *submitted* to journals, and not the final, peer-reviewed, *published* version, which scholars need as their "interface with officialdom", even though often HEP scientists submit also their final author-formatted peer-reviewed "post-print" to arXiv.

A powerful synergy is arising between the strong OA attitude of the HEP community, which finds its roots in the pre-print culture, and its continuing need for high-quality journals, leading to a unique opportunity for a possible transition to OA publishing of the entire HEP peer-reviewed literature. The community is now moving towards such groundbreaking transition through the establishment of the Sponsoring Consortium for Open Access Publishing in Particle Physics (SCOAP^3). This consortium would engage publishers of high-quality peer-reviewed journals in order to cover the costs of the peer-review process by re-directing funds previously used for journal subscriptions, making the published version of the articles OA. This article provides a short description of the SCOAP^3 initiative: section 2 puts the HEP publishing landscape in context and discusses the background to OA publishing in this discipline, together with the steps which led to the SCOAP^3 initiative; section 3 presents the main principles of the SCOAP^3 model; section 4 illustrates the results of an analysis of the HEP publishing landscape leading to the financial aspects of the SCOAP^3 model presented in

section 5; section 6 concludes the article by presenting the current status of the initiative at the time of writing and its outlook.

2. BACKGROUND

A recent study [8] analyzed articles submitted in 2005 to the arXiv repository in its four sub-sections devoted to HEP, *hep-ex, hep-lat, hep-ph* and *hep-th,* and subsequently published. Out of a total of about 5'000 articles, more than 80% appeared in just six peer-reviewed journals from four publishers: *Physical Review* and *Physical Review Letters* (published by the American Physical Society), *Physics Letters* and *Nuclear Physics* (Elsevier), the *Journal of High Energy Physics* (SISSA/IOP) and the *European Physical Journal* (Springer). Almost 90% of the articles were published by just four publishers, two out of which (the American Physical Society and SISSA/IOP) are learned society.

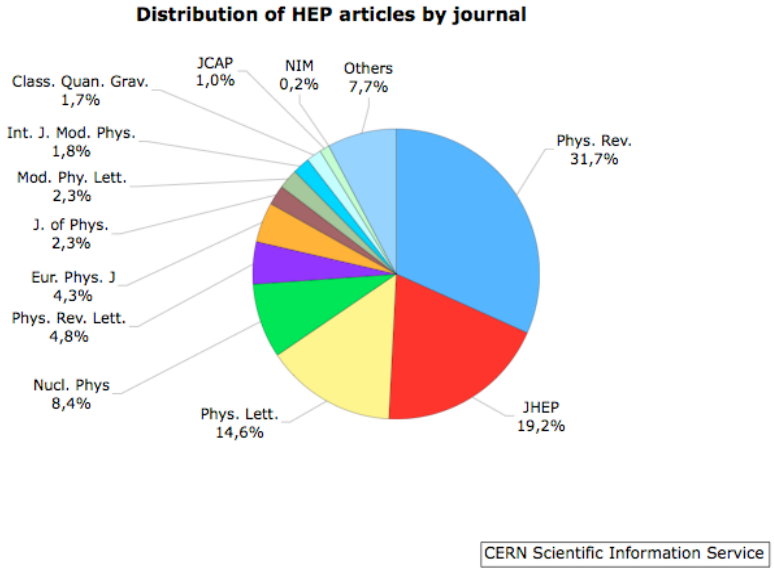

Figure 1 Distribution of the 5'016 HEP articles submitted in 2005 to the arXiv repository and subsequently published in peer-reviewed journals. Only journal with a total share above 1% are considered, with the exception of a popular title, *Nuclear Instrument and Methods in Physics Research* (NIM), whose author base has a poor self-archiving record. The "Others" group comprises 77 remaining journals. From reference [8].

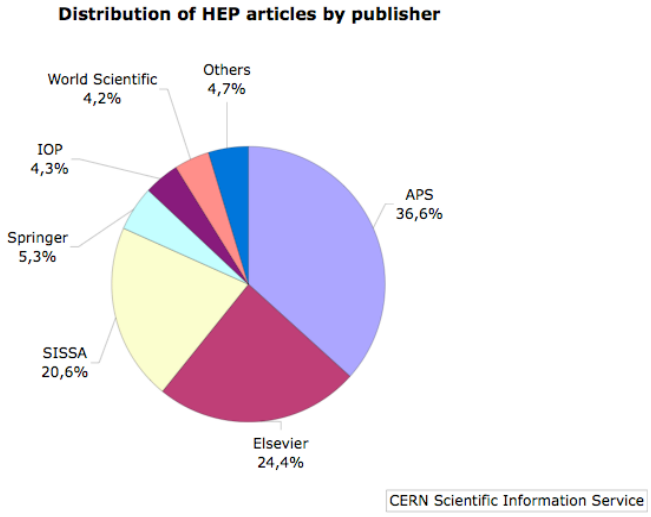

Figure 2 Distribution by publisher of the 5'016 HEP articles submitted in 2005 to the arXiv repository and subsequently published in peer-reviewed journals. From reference [8].

These findings, summarised in figures 1 and 2, spotlight two fundamental points relevant for a possible transition of HEP publishing to OA: the volume of articles is altogether small and concentrated in a few core titles published, for a large part, by learned societies.

All leading HEP journals have recently taken a pro-active stance on OA. Journals by the American Physical Society [9], Elsevier [10] and Springer [11] offer authors an option to pay a fee for making their articles OA. This model has met little success: authors have little motivation to pay this additional fee when they usually make the results of their research OA by submitting their pre-print, or even their post-print, which includes all corrections agreed during the peer-review process, to arXiv.

The *Journal of High Energy Physics* is recently experimenting with an institutional (and in one case national) membership fee [12]: for a modest contribution in addition to subscription prices, all articles originating from a given institution (or an entire country) are made OA. This appears to be more successful since funding mechanisms in HEP seldom include earmarked funds to finance OA publishing. Moreover, the direct payment for the OA publication of an articles is perceived very negatively by the community since it is reminiscent of the unpopular "page charges" of some journals. This perception might have extended to other journals, such as the IOP *New Journal of Physics* [13] and, recently, PhysMathCentral *Physics A* [14], which are built on a "pay-per-article" OA model. While the latter a new enterprise, and proposes institutional membership along the business model of its parent company, BioMedCentral, the former has so far attracted only a limited fraction of HEP content in its ten-year life. Recently, two publishers, Hindawi [15] and Bentham [16], have announced "author-pays" HEP OA journals, which have not yet published articles.

Some diffidence concerning "author-pays" initiatives is also harboured in library circles: if more and more authors favour pay-per-article publications, through library funds, libraries will be faced with a net increase of expenses: in addition to increasing OA fees, as the volume of articles in OA journals increases, they have to continue paying subscriptions, as subscription journals which see a decrease of articles in favour of new, OA, publishing outlets seldom reduce their subscription prices accordingly.

The debate on OA publishing in HEP was initiated by CERN, the leading HEP laboratory, with over half a century of history. Its flagship program, the LHC accelerator, starting in 2008 after 15 years of preparation, will see four large experimental collaborations probe fundamental questions in our understanding of the universe. CERN epitomizes cross-border collaboration in HEP: the LHC accelerator and detectors include components built in laboratories and universities around the world; the largest of the LHC experimental collaborations count as many as 2000 scientists, including about 400 students from a total of 160 universities and laboratories spread over 35 countries. Upon CERN fundation in Europe from the ashes of scientific research after the second world war, its convention enshrined an *ante-litteram* OA manifesto mentioning that: "[...] *the results of its experimental and theoretical work shall be published or otherwise made generally available*" [17]. Half a century later, as part of its role to chart the future of HEP, in synergy with leading libraries, library consortia and HEP funding agencies worldwide, CERN promoted several events focussed on OA publishing in HEP.

- In September 2005, the *Open meeting on the changing publishing model* brought together for the first time representatives of authors, funding agencies and publishers with the aim of discussing HEP publishing issues such as costs and their fair distribution, competition, opportunities for developing countries, alternative business models and the quality of peer-review [18].
- In December 2005, the *Colloquium on Open Access publishing in particle physics*, with the participation of representative groups of authors, funding agencies and

publishers, indicated possible ways towards OA publishing, based on three pillars: asserting the complementary roles of repositories and peer-reviewed literature, decoupling preservation issues and the publication model, enshrining the importance of peer-review for evaluation and academic credibility [19].

- From December 2005 to June 2006, a tri-partite *Task Force on Open Access Publishing in Particle Physics*, composed of authors, funding agencies and publishers, was charged by the main stakeholders to "… *study and develop sustainable business models for OA publishing for existing and new journals and publishers in particle physics* ...". In its report [2], the task force suggested to establish a sponsoring consortium, SCOAP^3, as a central body which would remunerate publishers for the peer-review service, effectively replacing the "reader-pays" model of traditional subscriptions with an "author-side" funding.
- In November 2006, following the task-force report and the acceptance of its model by representatives from major European stakeholders [20], a Working Party was established to develop a specific proposal for the creation of SCOAP^3, which is described in this article. More information is available in the SCOAP^3 Working Party report [21] and its Executive Summary [22].

3. THE SCOAP^3 MODEL

SCOAP^3 will act as a single interface between the main stakeholders of the HEP scientific information market: on one side the author and reader communities and on the other side the publishers of high-quality HEP journals. The aim of SCOAP^3 is to establish OA to HEP peer-reviewed articles along the lines of the Budapest Initiative [23], namely *"free availability on the public internet, permitting any users to read, download, copy, distribute, print, search, or link to the full texts of these articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself".*

Today, HEP literature is already, *de facto*, OA, as it is almost entirely available on arXiv, free of charge. Libraries are effectively supporting the peer-review system by purchasing journal subscriptions and, additionally, provide their users with access to the literature, access which they mostly already enjoy through pre-prints. Tomorrow, in the SCOAP^3 scheme, libraries and funding bodies will openly cover the costs of the peer-review service needed by their users and scholars, respectively, providing at once universal access.

SCOAP^3 aims to federate libraries, library consortia and funding agencies worldwide to cover the costs of peer review and provide access to HEP content: the SCOAP^3 model will only be successful if all countries contributing to the vast majority of the HEP literature become members of the consortium. Indeed, a pillar of the SCOAP^3 model is to ensure OA to all HEP articles appearing in high-quality journals, irrespective of the affiliation of their authors. Manuscripts from authors without academic affiliation or authors from less-privileged countries, which cannot be reasonably expected to contribute to the consortium at this time, will be treated like all other articles. The ethical reason of conserving the access to peer review for any author is obvious. At the same time, this choice has solid financial reasons: restricting OA privileges only to authors affiliated to institutions in some countries, as in all present OA schemes, would simply replace the present toll-access barriers with different barriers, connected to the geographical origin of the articles. Moreover, if only a geographical subset of the HEP scientific literature were available OA, consortium members would still be required to purchase the remaining fraction, with no evident financial benefits from the OA transition.

SCOAP^3 will be financed with funds currently used for subscriptions to HEP journals by libraries, library consortia, HEP laboratories and funding agencies. Each country will

contribute to SCOAP^3 in a "fair" way, according to its share of the worldwide HEP scientific production, as discussed in Section 5.
The innovation of the SCOAP^3 model with respect to other OA options currently offered by most publishers is that it will centralize all OA expenses, which will not have to be borne by authors and research groups. These other "author-pays" options, of scarce success in HEP, are perceived as an even higher barrier than subscription charges, in particular for theoretical physicists from small institutions, whose articles account for the vast majority of HEP scientific publications [8].
SCOAP^3 will contribute to stabilize the rising cost of access to information in the HEP domain by virtue of increasing author awareness to costs and prices, and by fostering new competition in the market, openly linking, for the first time in scholarly communication, quality and price.
A large fraction of the publications on core HEP subjects is published in a limited number of journals [8, 21, 24], as detailed in sections 2 and 4. Among those journals, some carry almost entirely HEP content. SCOAP^3 aims to assist publishers in converting these entire "core" journals to OA. It is expected that the vast majority of the SCOAP^3 budget will be spent for "core" journals with a negotiated price for the peer-review of all articles processed by a journal. Many HEP articles appear in "broadband" journals, which carry just a small fraction of HEP content. It is expected that these articles will be sponsored by SCOAP^3 on a "pay-per-article" basis. Conference proceedings and monographs are not within the scope of SCOAP^3.
In the SCOAP^3 model, the publishers will have the prime responsibility of ensure quality of the highest standards through independent editorial boards and their peer-review service. They will ensure the dissemination of OA articles by posting them onto their web sites and, in addition, feeding them to a SCOAP^3 repository, from which they will be fed into any other repository requesting them. The appeal of this model is the synergy between achieving OA through repositories and achieving OA through OA journals: SCOAP^3 will make the contents of the latter available through the former.
Publishers will benefit from a more sustainable business model than the traditional subscription scheme, becoming increasingly fragile. They will continue to meet the demand for print subscription, re-print of single articles, color plates in these printed versions, collections of articles in electronic or paper form, citation databases and other "premium" services, which are outside the scope of SCOAP^3.

4. THE HEP PUBLISHING LANDSCAPE

The original definition of HEP concerns the theoretical and experimental study of particles produced at accelerators of ever-increasing energy. With time, both the field and its definition have evolved to include subjects overlapping with cognate disciplines: nuclear physics, astrophysics, astroparticle physics and cosmology. Different authors, different journals and different funding agencies focus on different parts of the HEP spectrum and therefore have a different definition of the field.
To be successful, SCOAP^3 should, at once, aim to convert to OA the subset of scientific literature of common interest to all players, while striving for as wide a scope as possible. A minimal set of common interest to the entire HEP community is constituted by a "core" set of topics, loosely related to the *hep-ex*, *hep-lat*, *hep-ph*, and *hep-th* areas of the arXiv repository. A wider definition of "HEP articles", covers, in addition to "core" articles, also those in other fields of relevance to HEP, such as selected topics in nuclear physics, astrophysics, gravitation and cosmology.
It is important to note that the vast majority of HEP articles are written by theoretical physicists and have on average 2.6 authors [8]. On the other hand, in the last decade,

publications on experimental results were often authored by up to 500 scientists while collaborations now publishing their analyses count up to 800 researchers and articles by the LHC collaborations will have up to 2000 authors.
In 2005, about 8'500 "HEP articles" were published in peer-reviewed journals, as included in the SPIRES database [6]. Of these, 5'200 articles are classified as "core" articles. Table 1 presents the most popular HEP journals and their corresponding publishers, together with the total number of articles published in 2005, N_{tot}. The number of HEP articles, N_{HEP}, is also listed together with the number of "core" articles, N_{core}. Only journals with $N_{HEP}>65$ are shown. The last two columns show the fractions f_{HEP} and f_{core} of HEP and core articles, respectively [21].

Journal	**Publisher**	$\mathbf{N_{tot}}$	$\mathbf{N_{HEP}}$	$\mathbf{N_{core}}$	$\mathbf{f_{HEP}}$	$\mathbf{f_{core}}$
Phys. Rev. D	APS	2285	2101	1635	92%	72%
JHEP	SISSA/IOP	859	859	840	100%	98%
Phys. Lett. B	Elsevier	957	862	740	90%	77%
Nucl. Phys. B	Elsevier	522	481	465	92%	89%
Phys. Rev. Lett.	APS	3836	407	279	11%	7%
Eur. Phys. J. C	Springer	331	272	234	82%	71%
Mod. Phys. Lett. A	World Scientific	281	216	138	77%	49%
Phys. Rev. C	APS	853	298	136	35%	16%
Class. Quant. Grav.	IOP	491	255	89	52%	18%
Int. J. Mod. Phys. A	World Scientific	878	143	88	16%	10%
J. Math. Phys.	AIP	446	108	74	24%	17%
J. Phys. A	IOP	850	78	65	9%	8%
Eur. Phys. J. A	Springer	458	91	58	20%	13%
JCAP	SISSA/IOP	156	128	57	82%	37%
J. Phys. G	IOP	414	87	55	21%	13%
Prog. Theor. Phys.	IPAP	159	68	54	43%	34%
Nucl. Phys. A	Elsevier	692	92	51	13%	7%
Gen. Rel. Grav.	Springer	190	103	20	54%	11%
Int. J. Mod. Phys. D	World Scientific	160	97	18	61%	11%
Nucl. Instrum. Meth. A	Elsevier	1371	312	16	23%	1%
Astropart. Phys.	Elsevier	85	74	13	87%	15%

Table 1: The most popular HEP journals and their publishers, together with the total number of articles published in 2005, N_{tot}; the number of HEP articles, N_{HEP}; and the number of articles in the HEP core subject, N_{core}. The journals are ordered in decreasing order of N_{core}. Only journals with $N_{HEP}>65$ are shown. The last two columns show the fractions f_{HEP} and f_{core} of HEP and core articles, respectively. From reference [21].

As discussed in section 2, the vast majority of content of arXiv tagged as HEP, appeared in just six peer-reviewed journals from four publishers [8]. Five out of these six journals carry a majority of HEP content, as listed in table 1, these are:

1. *Physical Review D* (published by the American Physical Society);
2. *Journal of High Energy Physics* (SISSA/IOP);
3. *Physics Letters B* (Elsevier);
4. *Nuclear Physics B* (Elsevier);
5. *European Physical Journal C* (Springer).

SCOAP[3] aims to assist publishers in converting these "core" journals entirely to OA.

As from the last column of table 1, these five "core" journals include up to 30% of articles beyond the core HEP topics, particularly in Nuclear Physics and Astroparticle Physics. These articles will also be included in the OA conversion of the journals. This is in the interest of the HEP readership and promotes the long-term goal of an extension of the SCOAP^3 model to these related disciplines.

The sixth journal, *Physical Review Letters* (American Physical Society), is a "broadband" journal, which carries only a small fraction (11%) of HEP content. SCOAP^3 aims to sponsor the conversion to OA of this fraction on an article-by-article basis. A similar approach holds for another popular "broadband" journal in instrumentation: *Nuclear Instruments and Methods in Physics Research A* (Elsevier), which carries about 25% of HEP content.

These seven journals covered, in 2005, around 4'200 core HEP articles and about 5'300 articles in the wider HEP definition, including all related subjects. The conversion to OA of these five "core" journals and the HEP part of these two "broadband" journals would cover over 80% of the core HEP subjects and over 60% of the entire HEP literature, including all related subjects. The remaining 3'300 HEP articles, not published in the journals mentioned above, are scattered over some 140 other journals.

It is important to note that the SCOAP^3 model should not be limited to this set of journals, which the SCOAP^3 report spotlights for sake of clarity, but is open to all existing and future high-quality journals which carry HEP content, within budgetary limits.

An interesting fact, which vindicates the necessity of a worldwide consensus for the implementation of the SCOAP^3 model, is the geographical origin of HEP articles and the geographical distribution of their publication outlets. Two of the journals mentioned above, *Physical Review D* and *Physical Review Letters*, are published in the US and four, *Journal of High Energy Physics*, *Nuclear Physics B*, *Physics Letters B, European Physical Journal C*, are published in Europe. Figure 3 shows that US journals see an equal amount of literature coming from the US, Europe and the rest of the world. European journals see slightly more literature coming from Europe, but still more than half of their publications originate outside Europe [24]. Therefore, for a conversion to OA of HEP literature, which would benefit all authors worldwide, a conversion of all journals, independently of their country of publication, is necessary.

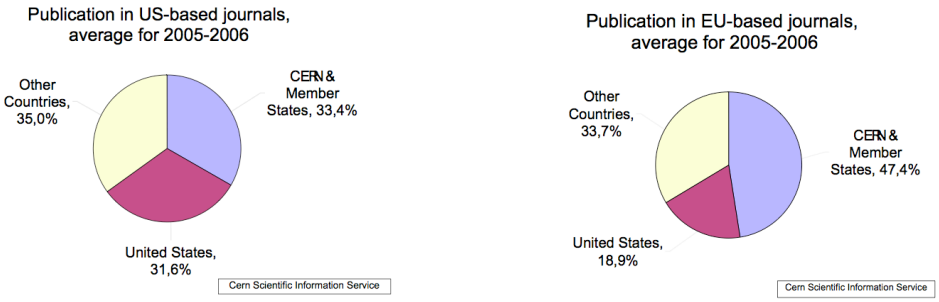

Figure 3 Origin of publications in US- and Europe-based journals. Co-authorship is taken into account on a pro-rata basis, assigning fractions of each article to the geographical reason in which the authors are affiliated. CERN and its Member States are, to a wide extent, a representation of Europe. From reference [24].

5. FINANCIAL ASPECTS OF THE SCOAP^3 MODEL

The price of an electronic journal is driven by the costs to run the peer-review system, by editorial costs for copy-editing and typesetting, by the cost for electronic publishing and access control, and by subscription administration. Some publishers today quote a cost, from reception to final publication, in the range of 1'000 –2'000 Euros per published article [25].

This includes the cost of processing articles which are eventually rejected, the fraction of which varies substantially from journal to journal.
The annual budget for a transition of HEP publishing to OA can be estimated from this figure and the fact that the journals, which cover a large fraction of the HEP literature, publish about 5'000 articles per year: the annual budget for a transition of HEP publishing to OA would amount to a maximum of 10 million Euros per year[1].
A "fair-share" scenario for the financing of SCOAP[3] is to distribute these costs among all countries active in HEP, on a *pro-rata* basis, taking into account the size of the HEP author base of each country. The rationale behind this scenario is that SCOAP[3] will be effectively covering the costs of the peer-review service and therefore the countries using this service more are naturally expected to contribute more. To cover publications from scientists from developing countries, which cannot be reasonably expected to contribute to the consortium at this time, an allowance of not more than 10% of the SCOAP[3] budget is foreseen.
The size of the HEP author base in each country is estimated from a recent study [21,24] which considered 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*, as well as those HEP articles published in the two "broadband" journals, *Physical Review Letters* and *Nuclear Instruments and Methods in Physics Research A*. A total sample of about 11'300 articles was considered and, for each of them, all authors were uniquely assigned to a given country, therefore assigning a fraction of each article to each country. Being an international laboratory, CERN was treated as an additional country. About 5% of the authors were found to have multiple affiliations, often in different countries, reflecting the intense cross-border collaborative tradition of HEP. In these cases, the ambiguity in the assignment of authors to countries was solved biasing a larger expenditure towards countries with a larger gross domestic product, as described in reference [24]. The results from this study are summarized in table 2 and figure 4.

Country	**Share of HEP Scientific Publishing**	**Country**	**Share of HEP Scientific Publishing**
United States	24.3%	Iran	0.9%
Germany	9.1%	Netherlands	0.9%
Japan	7.1%	Portugal	0.9%
Italy	6.9%	Taiwan	0.8%
United Kingdom	6.6%	Mexico	0.8%
China	5.6%	Sweden	0.8%
France	3.8%	Belgium	0.7%
Russia	3.4%	Greece	0.7%
Spain	3.1%	Denmark	0.6%
Canada	2.8%	Australia	0.6%
Brazil	2.7%	Argentina	0.6%
India	2.7%	Turkey	0.6%
CERN	2.1%	Chile	0.6%
Korea	1.8%	Austria	0.5%
Switzerland	1.3%	Finland	0.5%
Poland	1.3%	Hungary	0.4%
Israel	1.0%	Remaining countries	3.7%

[1] Another indication which corroborates this estimate is that the costs to run a "core" journal such as *Physical Review D,* amount to 2.7 Million Euros per year [25] and it covers about a third of the HEP publication landscape [8].

Table 2: Contribution to the HEP scientific publishing of several countries. 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. The last cell aggregates contributions from countries with a share below 0.4%. 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*. A total sample of about 11'300 articles is considered. From reference [21].

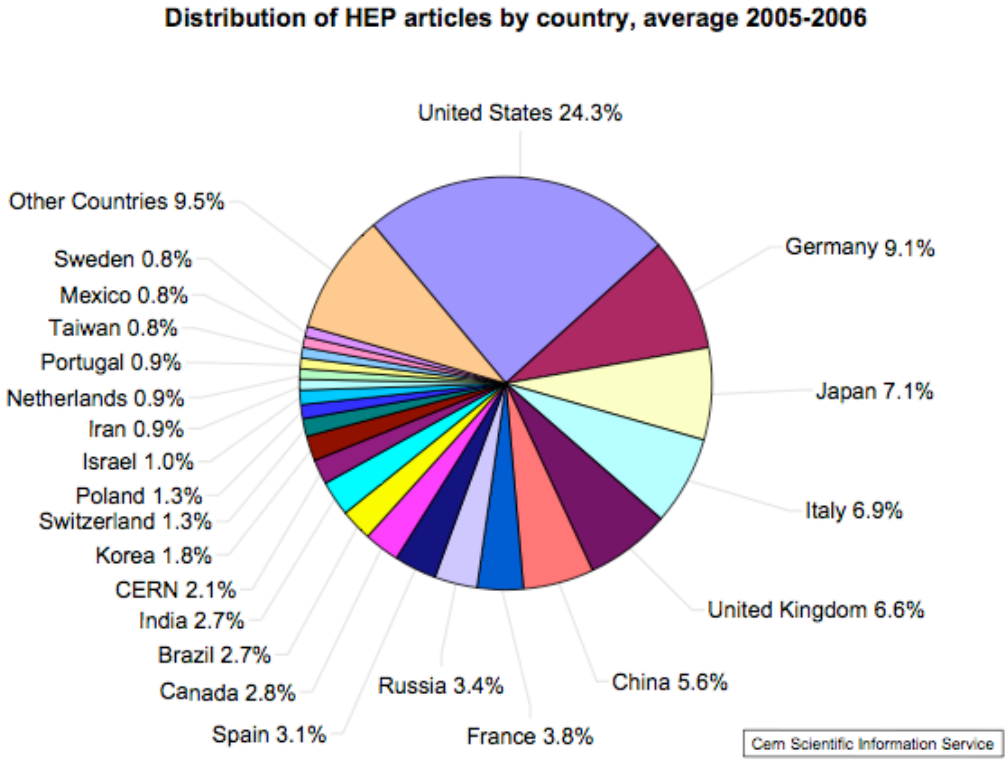

Figure 4: Contribution to the HEP scientific publishing of several countries. Co-authorship is taken into account on a pro-rata basis, assigning fractions of each article to the countries in which the authors are affiliated. A total of 11'300 articles published in the years 2005 and 2006 is considered, covering entirely 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*. Contributions from countries with a share below 0.8% are aggregated in the slice denoted as "Other Countries". From reference [21].

Three transitional aspects in the implementation of the SCOAP³ model are particularly relevant [21].

1. Journal licence packages. In the case of "core" HEP journals which will be entirely converted to OA, and which are part of a large journal licence package, a contractual condition to the publishers will be to extract these titles from the package and to correspondingly reduce the subscription cost for the remaining part of the package.
2. Partially-converted journals. For "broadband" journals, where only the conversion of selected HEP articles is paid by SCOAP³, a contractual condition for publishers will be to reduce the subscription costs according to the fraction of content supported by SCOAP³. For journals of this kind that are part of a licence package, the reduction should be reflected in a corresponding reduction of the package subscription cost.
3. Multi-year subscriptions contracts. In the case of existing long-term subscription contracts between publishers and libraries or library consortia, a contractual condition for publishers will be to reimburse the subscription costs pertaining to OA journals or to the journal fractions converted to OA.

6. BUILDING THE SCOAP^3 CONSORTIUM

The fundamental pillar of the SCOAP^3 model is the federation of libraries, library consortia, HEP laboratories and HEP funding agencies worldwide to cover centrally the costs of peer-review in HEP publishing, while making HEP publications OA. This conversion to OA of HEP literature, with all the ethical, scientific and financial benefits it implies, can only be achieved in a global co-ordinated process. A crucial step towards OA publishing in HEP is therefore the establishment of worldwide consensus around the SCOAP^3 initiative. This consensus will be reflected in financial pledges from each country for its share of the yearly SCOAP^3 costs. These contributions are calculated as from the percentages of HEP authorship of each country, presented in table 2, taking into account a global budget envelope of 10 million Euros, and an additional contribution from each country of 10% to cover authors in countries which cannot be expected to contribute to the consortium at this stage.

At the time of writing, in early December 2007, partners from many European nations have pledged, over a few weeks, over ¼ of the budget envelope of SCOAP^3: a total of 2.5 million Euros, covering the contribution of Germany, Italy, France, CERN, Sweden and Greece will be made available for the initiative. Intense discussions are underway within the remaining European countries, many of which are expected to join the consortium in the immediate future. Entities in Asia and in the United States are also considering the model, and signs of interest are appearing from leading libraries and library consortia in the United States. The situation is in continue evolution and can be monitored on the consortium website [26].

Once sufficient funds will have been pledged towards the establishment and the operation of SCOAP^3, from partners around the world, a tendering process involving publishers of high-quality HEP journals will take place. Provided that the SCOAP^3 funding partners are ready to engage into long-term commitments, most publishers are expected to be ready to enter into negotiations along the lines presented in this article.

The outcome of the tendering process will allow the complete SCOAP^3 budget envelope to be precisely known and will trigger the formal establishment of the consortium and the definition of its governance. Finally, contracts with publishers will be established in order to make Open Access publishing in High Energy Physics a reality, when the first experimental and theoretical publications of the LHC program, a watershed in the history of HEP research, will appear.

It is important to remark how this process is driven by the author community: at the beginning of 2007, the large scientific collaborations giving the final touch to the particle detectors of unprecedented complexity to be used for discoveries at the LHC, counting a total of over 5'000 scientists, each voted, unanimously, a statement in support of OA publishing: "*We strongly encourage the usage of electronic publishing methods for our publications and support the principle of Open Access Publishing, which includes granting free access of our publications to all. Furthermore, we encourage all collaboration members to publish in easily accessible journals, following the Open Access Paradigm.*" [21]

The conversion of the HEP scientific publishing to the OA paradigm, along the lines of the SCOAP^3 model, will be an important milestone in the history of scientific publishing. The SCOAP^3 model could be rapidly generalized to other disciplines and, in particular, to related fields such as Nuclear Physics or Astroparticle Physics and to all disciplines which are practiced by a compact and closely-knit community, with a limited number of publishing outlets, and a strong presence of learned-societies in the publishing process.

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