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Open Access Publishing in Particle Physics: A Brief Introduction for the non-Expert *

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Open Access to particle physics literature does not sound particularly new or exciting, since particle physicists have been reading preprints for decades, and arXiv.org for 15 years. However new movements in Europe are attempting to make the peer-reviewed literature of the field fully Open Access. This is not a new movement, nor is it restricted to this field. However, given the field's history of preprints and eprints, it is well suited to a change to a fully Open Access publishing model. Data shows that 90% of HEP published literature is freely available online, meaning that HEP libraries have little need for expensive journal subscriptions. As libraries begin to cancel journal subscriptions, the peer review process will lose its primary source of funding. Open Access publishing models can potentially address this issue. European physicists and funding agencies are proposing a consortium, SCOAP3, that might solve many of the objections to traditional Open Access publishing models in Particle Physics. These proposed changes should be viewed as a starting point for a serious look at the field's publication model, and are at least worthy of attention, if not adoption.

In November 2006 a meeting of European particle physics laboratories, funding agencies, librarians, and researchers took place at CERN. After the meeting it was announced [1] that an interim working party had been formed to proceed with an initiative known as the Sponsoring Consortium for Open Access Publishing in Particle Physics (SCOAP3). This announcement was the latest of several that have begun to make the particle physics community more aware of the the Open Access movement and its relation to the publication of physics literature. However there are still many who are unaware of the issues involved, and of the new directions suggested by the European particle physics community. An overview of this movement and its relation to particle physics is presented herein. It is necessarily an oversimplification of some issues, and the reader is urged to consult the references herein, or your local librarian to find out more detail.

The Open Access (OA) movement has been formalized over the past several years to advocate for a change in the methods involved in the distribution of academic literature [2]. In short, an Open Access article can be roughly defined as one that is freely available to read immediately after traditional peer-review, in perpetuity, and with unrestricted use[3]. This is in contrast to most scientific literature, which currently requires a subscription fee in order to read the article online or receive a hard copy by mail.

Note that Open Access is not the same as electronic access. Many researchers are able to read all relevant articles online as soon as they are published, but this is due to libraries paying fees for online (and print) subscriptions. In recent years these subscription costs have been rising precipitously [4], causing some to worry about the sustainability of the communication model wherein authors generate papers, and libraries pay to obtain access to them. As library budgets are pressured and serials costs grow, some journals are necessarily cut and researchers lose access to literature. This area of concern is known as the serials crisis. Open Access advocates often speak of resolving the serials crisis [5], though that is by no means the sole, or even primary, goal of the movement.

Harnad et.al. describe two roads to open access, the green and the gold. [6] The gold road is the formation and support of Open Access journals. This is the focus of the recent discussion in Europe, and is the most relevant for particle physics. However, as background, one should understand the so-called *green road*, also known as *self-archiving*. This is simply an author posting preprint (and post-print) copies of their papers online on her own repositories, on eprint archives such as arXiv.org, or in institutional repositories [7]. Authors can achieve the laudable goal of providing universal, free access to their work without worrying about the business models of publishers. Authors should be excited about this prospect because their work is then more visible to other researchers, and in turn they can more easily find and read works of interest to them. Note that this does not solve the serials crisis at all, but perhaps once this level of access has been achieved, journal business models may change in response.

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In Particle Physics, self-archiving has existed for 15 years using arXiv.org as a repository for articles, and SPIRES as the search engine that unifies the literature[8]. By studying SPIRES data one finds that the fraction of published articles on arXiv is well over 95% for large mainstream journals like Nucl. Phys. B and Phys. Rev D. Smaller, less mainstream journals tend to have a lower arXiv rate, but in general around 90% of published, peer-reviewed HEP literature (not including conference proceedings) from the last 10 years is available online freely at arXiv. Thus particle physics, unlike other fields, can essentially ignore calls to self-archive its papers, since this has already been accomplished.

However, HEP libraries still face a serials crisis. One might propose that a simple solution would be to cancel all journals that are solely particle physics, since the content is essentially freely available. However, this is not occurring, and more to the point, this would be a disaster for the field if it did occur. Physicists continue to publish as much as before self-archiving was a reality. In fact in the hep-th section of arXiv.org, around 75% of the articles are eventually published in journals [9]. Why do they publish? It isn't certain, but one can see that journals are not used for communication within the field, due to the high rate of arXiv submissions.

Because journals are not used for communication, one of their only remaining uses is to provide peer-review. If particle physics journal subscriptions were all canceled, the mechanism for peer-review would be jeopardized. So, while particle physics clearly already has Open Access in the "green road" sense, the field has an odd model where libraries essentially subsidize the cost of peer-review and other functions of journals. Since physicists can read articles without these subscriptions, this subsidy is entirely voluntary on the part of the libraries, but is necessary for the field as a whole. As libraries face increasing journal costs, they have little incentive to continue to buy journals that are not used for communication. Libraries currently fund essentially 100% of the peer-review process in HEP[10], while the product that they get in return for their payment is 90% freely available on arXiv.org. As university and laboratory libraries begin to look more closely at their serials collections, these subsidies for the peer-review process may begin to disappear.

Enter the "gold road" or Open Access journal. There are several different business models for a an Open Access journal, but it cannot, by definition, use the "pay to read" model. The "pay to read" model made sense when the cost of distribution scaled with the number of copies produced. Now, since most dissemination can be handled electronically, the primary costs (peer-review, servers, etc) scale with the number of articles published or submitted. Thus some journals are shifting to an "pay for publication" model of dissemination in which authors of research articles (more often their funding agencies) pay a fee to a publisher who in turn reviews the article and disseminates it to the public for free. This puts the burden of paying for peer-review back on the authors and their funding agencies, i.e. the people who generate the research that requires, and benefits from, review. Other models of Open Access journals include direct funding from grants, advertising, and charging for related/add-on products. For example, Phys. Rev. Special Topics: Accelerators and Beams is Open Access via a sponsorship model, whereby accelerator laboratories worldwide sponsor the journal so no subscription is needed[11]. However, the "pay to publish" or "author pays" model is the most common, and the one of the most relevant to particle physics.

There are arguments against the "pay to publish" implementation of Open Access in journals (see, e.g. [7],[12]). These include:

- Conflict of interest: if a journal gets money from its authors, might it not treat the peer-review process differently? Quality might diminish. Yet it is not clear what a journal would gain in the long term by publishing low-quality material. Impact factors and community judgment would quickly remove any temporary financial incentive to do this.
- Poorer researchers/institutions: Poorer researchers might not be able to pay open access author fees. It should also be noted that most author-pays models propose to operate at the level of line-items on grants, so that the relative wealth of an individual author or institution is irrelevant in practice. At a national level, there are current programs that work to reduce the costs of journals in developing nations[13], and these practices could carry over into a pay to publish model. Further, it should be noted that a pay to publish model shifts the financial burden of reviewing the research literature to the producers of that literature. This implies that larger institutions, which produce large amounts of research, will support a larger fraction of peer-review costs for the field. This seems as though it would benefit, rather than hurt, small institutions. However, smaller institutions still may have very active theory groups which produce a large amount of research output. This might lead to a problem under a simple author-pays model, since theorists write the vast majority of the papers in the field [14], but aren't necessarily at major institutions. Finally note that Open Access to the literature itself (via either road) does nothing but help poorer institutions, by removing the cost of obtaining scientific literature from their research overheads.
- Authors won't pay: if scientists are forced to choose between paying for research needs (graduate students, equipment, etc.) and strange new open access fees, almost all will choose research. Hence any pay to publish

model must provide institutional and funding agency policies that not only recommend or require open access publication, but also provide funds earmarked for this purpose. It may even be preferable to use libraries and/or some other external infrastructure to pay these costs, so that authors need not worry about new details.

- Libraries pay twice: If libraries continue their subscriptions, which of course they must until a large quantity of literature is open access, then they are paying the publisher for articles that the author already paid for access to. Only if journal subscriptions are canceled or prices drop with the fraction of open access articles will there be a cost savings. In any case there is a transitional period during which there is probably no way to avoid some extra costs. If a journal completely transitions to an Open Access model, then this objection is eliminated, since there is no longer any subscription fee. However, if the journal publishes some articles of each type without decreasing subscription costs, or if it bundles OA journals with non-OA journals in package deals, then this double payment could occur.

It seems clear, though not unambiguously so, that open access is a general good for the research community. Further it seems that, in a field which has Open Access to its literature, a “pay to publish” model for peer-review costs makes more sense than a “pay to read” model. Particle physics is thus in a position where the transition to a “pay to publish” model might make some sense, and might be particularly easy.

With this background one can now understand the role and significance of SCOAP3 consortium recently proposed by European funding agencies [15], [1],[16]. With the start of the LHC at CERN there is an opportunity to transition all of the literature of the field to the “pay to publish” model. SCOAP3 proposes to pay author fees for Open Access in a “pay to publish” model for a large segment of the physics literature. The proposal would make the change transparent to authors themselves as SCOAP3 and the main funding agencies shift subscription costs to cover publication charges centrally. [17] SCOAP3 would essentially provide bridge funding to help authors, journals, and libraries transition to this model, preventing much of the double charging that might occur. After a transition period of 3-5 years one would hope that libraries and/or funding agencies would be paying publication charges, rather than subscriptions, for all particle physics journals, and libraries would no longer need to voluntarily subsidize the peer-review services of journals. SCOAP3 might continue to exist after the transition as well, as an umbrella consortium for libraries and funding agencies funding Open Access payments.[16]

Note that this movement is not aimed at specific journals or publishers. At present almost all relevant journals currently provide authors with an option to pay for OA (costs from \$900-\$3000/article), or are ready to implement such a structure immediately. This includes Phys Rev D, Phys Rev Lett, JHEP, Nucl Phys B, Phys. Lett. B, Eur. J. Phys, Nucl Inst. Meth, J Phys G, and others. There are also fully Open Access journals emerging like New Jour. Phys. and PhysMathCentral. Authors and funding agencies who wish to can pay for their articles to be Open Access in most of these journals today. Authors, of course, should not generally be expected to volunteer to pay this cost, any more than libraries or publishers, so funding agencies that fund both subscription costs and authors doing research must be the instruments of change. For real change to happen the movement needs to include not only Europe but the United States, Asia, and the entire world. To this end libraries, authors, and funding agencies should make themselves aware of the journals’ policies, the proposed role of SCOAP3, and the arguments for and against such a move. These issues demand attention and action from all parties involved in the production and dissemination of particle physics literature.

Regardless of your position on open access and the “pay to publish” model, it is clearly an exciting time in particle physics communication, and change is almost certainly on the horizon. Finally, thanks are due to the people who have advocated and organized to help prepare the field to make this change. Open Access in particle physics was a reality 15 years ago due to arXiv.org and SPIRES. Now, thanks to CERN and others, the field has the unique opportunity to change its publication model in a way that might match its communication model

[1] <http://public.web.cern.ch/press/PressReleases/Releases2006/PR16.06E.html>

[2] A nice Timeline of the Open Access movement can be found at <http://www.earlham.edu/peters/fos/timeline.htm>

[3] Note that other definitions exist, and Open Access has a wide range of voices. See, for example, <http://www.plos.org/oa/definition.html> <http://www.eprints.org/openaccess/> <http://www.earlham.edu/peters/fos/>

[4] <http://www.arl.org/stats/arlstat/graphs/2004/monser04.pdf> [pdf file]

[5] For example: P. Suber, College & Research Libraries News, 64 (February 2003) pp. 92-94, 113 [<http://www.earlham.edu/peters/writing/acrl.htm>]

[6] S. Harnad, et al. Nature Web Focus, Access Debate. <http://www.nature.com/nature/focus/accessdebate/21.html>

[7] <http://www.eprints.org/openaccess/self-faq/>

[8] Before the electronic era, a similar culture existed around paper preprints, with SPIRES serving as the unifying catalog.

[9] SPIRES data

- [10] With the exception of volunteer referees, there is no other funding source for most existing peer review.
- [11] <http://prst-ab.aps.org/help/sponsors.html>
- [12] “Electronic Scientific, Technical, and Medical Journal Publishing and Its Implications:Report of a Symposium” 2004, National Academies Press [<http://www.nap.edu/catalog/10969.html>]
- [13] For example <http://www.eifl.net/>
- [14] SPIRES data - Over 90% of published, non-conference, particle physics literature in 2005 was theoretical or phenomenological. Conferences tend to have more experimental work, but are still theory dominated.
- [15] <http://cdsweb.cern.ch/record/1020110>
- [16] <http://open-access.web.cern.ch/Open-Access/>,<http://open-access.web.cern.ch/Open-Access/SCOAP3WPReport.pdf> and <http://indico.cern.ch/conferenceDisplay.py?confId=7168>
- [17] S. Mele et. al. JHEP12(2006)S01 [[cs.DL/0611130](https://arxiv.org/abs/cs.DL/0611130)]