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The American Physical Society's response to the OSTP's request for information on "Public Access to Peer-Reviewed Scholarly Publications Resulting from Federally Funded Research," FR Doc. 2011-28623

Introduction

The American Physical Society (APS) was founded in 1897 with the objective to advance and diffuse the knowledge of physics. While this objective is now understood to include physics education and outreach, public affairs, scientific meetings, and international collaborations, the publication of significant advances in physics has been central to APS since 1913, when we became the publisher of the *Physical Review*, a journal founded at Cornell University in 1893. Since that time, APS physics journals have grown tremendously. We now publish ten journals: *Physical Review A-E* (each journal dedicated to a particular subject area in physics), *Physical Review Letters*, *Reviews of Modern Physics*, *Physical Review Special Topics – Accelerators and Beams*, *Physical Review Special Topics – Physics Education Research*, and *Physical Review X*. The last three are Open Access journals whose peer-review and other operating costs are covered by contributions or publication fees. Our other journals are available through subscriptions held by a variety of individual institutions and consortia around the world. The *Physical Review* journals and *Physical Review Letters* (our flagship journal) allow authors or their sponsoring institutions to pay an article-processing charge to have an individual article made freely available. All APS Open Access articles are available under the Creative Commons Attribution 3.0 License, and we no longer hold copyright to these articles. All APS journal content (back to 1893) was made available online by the end of 2001, making us one of the very first publishers to put our entire corpus online.

The APS journals are broadly international in scope. Only about 30% of our submissions (and published articles) come from authors within the U.S. Similarly, only about one third of our subscription revenue comes from the U.S. The remaining submissions and revenues are roughly equally divided between Europe and the Asia-Pacific region.

The APS has a long history of support for Open Access initiatives. In 1998, we became the first fully "green" publisher when we amended our copyright transfer statement to explicitly allow authors to post their manuscripts (both new and previously published) on e-print servers, such as arXiv.org, and to post PDFs of their APS-published articles on their home pages or institutions' web sites. Indeed, the recent content of one of our journals, *Physical Review D*, is essentially completely available on arXiv.org because of submissions by the authors themselves. *Physical Review Special Topics – Accelerators and Beams* was one of the earliest "gold" Open Access journals. It started publication as an Open Access journal in 1998 and is supported by contributions from accelerator laboratories around the world. Authors and readers incur no fees for this journal. In November 2009, the APS Council adopted the following statement:

The APS supports the principles of Open Access to the maximum extent possible that allows the Society to maintain peer-reviewed high-quality journals, secure archiving, and the Society's long-term financial stability, to the benefit of the scientific enterprise.

In keeping with our objective, APS also recognizes the importance of making the research published in our journals as widely available as possible, even to the general public. We believe that it is essential for the general public to have access through our web site to the full, final, peer-reviewed content of all APS journals. This ensures that the public sees the official "version of record," including any updates or corrections. Thus, in July 2010, we pioneered a program that allows any U.S. public library to sign up for free subscriptions to all of our journals. After a librarian at a public library completes a simple online form, agreeing to straightforward terms and conditions, we grant access promptly (usually in one business day). Any person visiting a participating public library can access the full content of our journals dating back to 1893. We are pleased that the Library of Congress was the very first public library to sign

up under this program. This program was subsequently extended to all U.S. high schools, and to date well over 500 libraries from around the country have taken advantage of this opportunity.

Finally, APS prides itself on subscription prices per article and per page that are among the lowest in the industry. We were the first publisher to introduce tiered pricing, allowing smaller institutions with little research activity to pay substantially less than the leading research institutions. Subscription prices for our highest and lowest tiers currently differ by more than a factor of two, and we continue to increase (gradually) this ratio. Our article-processing fees for Open Access articles cover the actual cost of reviewing and publishing an article (without charging for submissions not accepted for publication), plus a very small margin that supports our the education and outreach activities. Twice in the most recent decade we have actually decreased our subscription prices as our expenses decreased (most recently in 2009). When we increase our prices the primary driving forces are inflation and growth in the number of manuscripts submitted for review (by 3-5% annually for many years).

OSTP Questions

(1) Are there steps that agencies could take to grow existing and new markets related to the access and analysis of peer-reviewed publications that result from federally funded scientific research? How can policies for archiving publications and making them publicly accessible be used to grow the economy and improve the productivity of the scientific enterprise? What are the relative costs and benefits of such policies? What type of access to these publications is required to maximize U.S. economic growth and improve the productivity of the American scientific enterprise?

In physics and closely related fields, U.S. federally funded research typically accounts for only one-third of peer-reviewed publications. Thus maximal U.S. economic growth and scientific productivity require access not only to results from federally funded research, but to the full output of the global scientific enterprise. American science benefits greatly from cost-effective society publishers such as APS who (at least in physics) currently publish the best science from the entire international scientific community. Maintaining stable business models for non-profit society publishers is crucial to the continuing success and growth of American science. Unfunded mandates or similar policies that jeopardize the modest revenue stream of scholarly society publishers threaten the scientific enterprise with increased costs for researchers to access global peer-reviewed scientific output. With the explosive growth of online information, one pressing need is for tools and resources to help researchers find efficiently the most relevant and most reliable information of interest to them. PubMed for the biomedical sciences is a good example of such a resource, but duplicating this resource for the physical sciences would be very costly (there is no physical-science equivalent to the National Library of Medicine to provide a pre-existing infrastructure). Furthermore, past efforts (PubSCIENCE by DOE's Office of Scientific and Technical Information) were closed down as a result of lobbying by commercial interests. One simple but effective measure would be a joint effort between publishers and funding agencies to adopt a standardized format for acknowledgments of federal grant support in the metadata of all peer-reviewed publications, which would provide easier identification of results from federally supported research for funding agencies, scientists, and the general public. More generally, common interfaces and standards for article metadata, established by agencies and international bodies, could serve the scientific enterprise by facilitating more efficient electronic search and discovery.

(2) What specific steps can be taken to protect the intellectual property interests of publishers, scientists, Federal agencies, and other stakeholders involved with the publication and dissemination of peer-reviewed scholarly publications resulting from federally funded scientific research? Conversely, are there policies that should not be adopted with respect to public access to peer-reviewed scholarly publications so as not to undermine any intellectual property rights of publishers, scientists, Federal agencies, and other stakeholders?

There are business models that protect the intellectual property of publishers and other stakeholders, but that still allow for full public access to all content. As mentioned in our introductory text, the APS makes its current content and its complete archive freely available to every public library in the US and every high school in the US, for in-house use. However, universities and laboratories still must maintain subscriptions to gain online access, and these subscriptions ultimately fund the management of the peer review process, XML composition, and the maintenance in perpetuity of all published content. This shows that it is possible to give full access to the public without making everything centrally accessible as in the PubMed Central model, which requires deposit of accepted peer reviewed articles, but not the version of record. Publishers make large investments in bringing articles to the point of acceptance, and PubMed Central requires that this be done, but provides no funding for this essential activity, and then frequently duplicates publishers' contributions such as conversion to XML.

A model that might be amenable to more publishers and that would be far less expensive than PubMed-type agency repositories would be to (1) require all federally supported papers to have an acknowledgment of the funding agency in the metadata in a standard form; (2) require granting agencies to use this to automatically harvest the metadata for all of the papers that they have supported and to put this metadata into an open, well-indexed, easily searchable database, including links to the publishers' versions of record (VoR); (3) require that in addition to a link to the VoR, the Principal Investigators (PIs) supply a link to an Open Access version of each federally supported paper (on arXiv, an institutional repository, an author's web site, etc.). The PIs' contributions to this system could be required as parts of annual and final reports, with penalties for noncompliance.

(3) What are the pros and cons of centralized and decentralized approaches to managing public access to peer-reviewed scholarly publications that result from federally funded research in terms of interoperability, search, development of analytic tools, and other scientific and commercial opportunities? Are there reasons why a Federal agency (or agencies) should maintain custody of all published content, and are there ways that the government can ensure long-term stewardship if content is distributed across multiple private sources?

A decentralized approach would charge the government with establishing and enforcing standards to facilitate interoperability, and would then rely on the enterprise of publishers to develop new and powerful tools for users. This could be done with little cost to the government, and would be consistent with our country's confidence that private enterprise and competitive markets, not government-controlled bureaucracies (no matter how well-intentioned), are the best sources of innovation and efficiency.

On the other hand, a centralized approach can be quite expensive. Even NIH, building from the world's largest medical library, has needed considerable funding to establish and maintain PubMed Central.

As a scientific society devoted to our field, we take the stewardship of our publications to be a deep and central obligation. We have made the full archive of our journals, spanning 118 years, available on our web site, and we maintain complete duplicate copies of this electronic archive at three geographically dispersed mirror sites. In addition, we pay Portico, an independent, community-supported digital archive (one of several such organizations) to maintain a widely distributed and redundant "dark archive" of our content, to be made available in the event of an unforeseen loss of our services. All of our content is also available in the Library of Congress, and can be viewed freely by anyone physically in the Library. Since preservation and stewardship are the traditional business of libraries, and not of funding agencies, another approach might be to assign this responsibility to the Library of Congress, along with adequate funding and staff.

We further note that government control of the primary public archive of scientific literature would raise unavoidable concerns about possible restriction or suppression of access to scientific results contrary to the beliefs of the government at a particular time, and hence runs counter to the principles of our free and open democratic society.

The current decentralized system has served science and society very well. Interactions among publishers, librarians, scientists, and entrepreneurs have produced powerful tools such as the CrossRef/DOI system and distributed archives such as Portico and CLOCKSS and continue through new initiatives for researcher identification such as ORCID and discovery services such as Mendeley.

(4) Are there models or new ideas for public-private partnerships that take advantage of existing publisher archives and encourage innovation in accessibility and interoperability, while ensuring long-term stewardship of the results of federally funded research?

PubSCIENCE, operated by DOE for a few years before it was closed, provided a central index of government supported research work that linked to publishers' sites. This type of service was a public-private partnership that might be rethought in light of new technological developments. It has the advantage of not requiring a costly central repository of articles that duplicates the work already done by publishers. However, as noted above, in the past such efforts have been hobbled by lobbying by commercial interests. Article rental schemes such as DeepDyve are a new way to provide modest levels of use to members of the general public, at reasonable cost per article, without threatening the heavily-used institutional subscriptions that support the peer review, composition, and online hosting and archiving provided by publishers. The APS public and high school library initiative described in our introduction and under question (2) provides another new model of public-private partnerships for public access. An extension of this model would be for research universities with federal funding above some threshold to provide public e-reading rooms with access to their online collections of scientific journals.

(5) What steps can be taken by Federal agencies, publishers, and/or scholarly and professional societies to encourage interoperable search, discovery, and analysis capacity across disciplines and archives? What are the minimum core metadata for scholarly publications that must be made available to the public to allow such capabilities? How should Federal agencies make certain that such minimum core metadata associated with peer-reviewed publications resulting from federally funded scientific research are publicly available to ensure that these publications can be easily found and linked to Federal science funding?

The publicly available core metadata for all APS journals consists of: Title, Authors, Affiliations, Abstract, Search/Semantic/Keywords, License information, Funding agency information, Digital Object Identifier (DOI), and Bibliographic References. Federal agencies could request that this metadata be deposited in a central location for all research funded by the agency. Availability of this data to the public would allow publishers to include it in their search engines, and Google Scholar could also facilitate searching the data.

(6) How can Federal agencies that fund science maximize the benefit of public access policies to U.S. taxpayers, and their investment in the peer-reviewed literature, while minimizing burden and costs for stakeholders, including awardee institutions, scientists, publishers, Federal agencies, and libraries?

Answers to this question are woven through many of the responses given above, but we also want to emphasize our conviction that system-wide mandates would be counterproductive on account of the widely varying research cultures, traditions, conventions, and approaches across scientific disciplines and the distinct missions, opportunities, and constituencies of different funding agencies.

(7) Besides scholarly journal articles, should other types of peer-reviewed publications resulting from federally funded research, such as book chapters and conference proceedings, be covered by these public access policies?

[No comment]

(8) What is the appropriate embargo period after publication before the public is granted free access to the full content of peer-reviewed scholarly publications resulting from federally funded research? Please describe the empirical basis for the recommended embargo period. Analyses that weigh public and private benefits and account for external market factors, such as competition, price changes, library budgets, and other factors, will be particularly useful. Are there evidence-based arguments that can be made that the delay period should be different for specific disciplines or types of publications?

The APS has download data that tell us directly how the use of articles varies with time since publication. Figure 1, the graph to the right, shows the downloads/article in 2009 of articles published during the period 1980-2009. There is a steep falloff with time, and we have fit the distribution with two exponentials, using a short half-life of 1 year for 75% of the articles and a long half-life of 34 years for 25% of the articles that are presumably more important. The net result is that 77% of the downloads of articles occur after the first year of publication, so requiring articles to be free after one year as in PubMed Central would deprive a physics publisher of 77% of the “interest” in its articles.

A crucial question raised by the current NIH policy is: “Will the funding of the peer review process by journal subscription income be lost if all content in a journal is freely available through repositories?” The APS download data can help to answer this question. One of the 10 APS journals, Physical Review D (PRD), covering elementary particle physics, field theory, gravitation, and cosmology, has 97% of its articles available in preprint form on the subject repository arXiv {<http://arxiv.org/>}. Figure 2 shows the download statistics for PRD and for three other APS journals in different fields of physics from 1980 to 2009. Note that significantly fewer authors of articles in topics covered by the three other journals, PRA (atomic, molecular and optical physics), PRB (condensed matter and materials physics) and PRC (nuclear physics), post their papers on the arXiv before submitting them for peer-review and publication. Thus this comparison of downloads is a direct comparison between content that is largely available on a central repository and content that is centrally available only by subscription.

The graph shows that PRD is downloaded from the APS journal site about 66% less frequently than are the other APS journals for the years where PRD pre-print articles appeared on the arXiv (1993 to the present). Note that the pre-arXiv (before 1993) downloads are about the same for PRD and the other journals.

We also note that APS has not lost subscriptions to PRD relative to our other journals. We believe that the main reason is that we provide a package of all of our journals, “APS-ALL”, and the cost of the package is less than the cost of buying separately each of the remaining journals without PRD. Also, because our prices are the lowest of all physics journals, the cost/download is still lower than for more expensive journals.

Librarians carefully monitor download statistics and frequently cite them to justify the cancelation of underused subscriptions. Based on the long-term data for PRD, we conclude that significant subscription income will be lost if all content of all journals is freely available through a repository. **The consequence for APS would almost certainly be a financial crisis that would eliminate many services to its members and to the global physics community together with vitally important contributions to physics education and public outreach.**

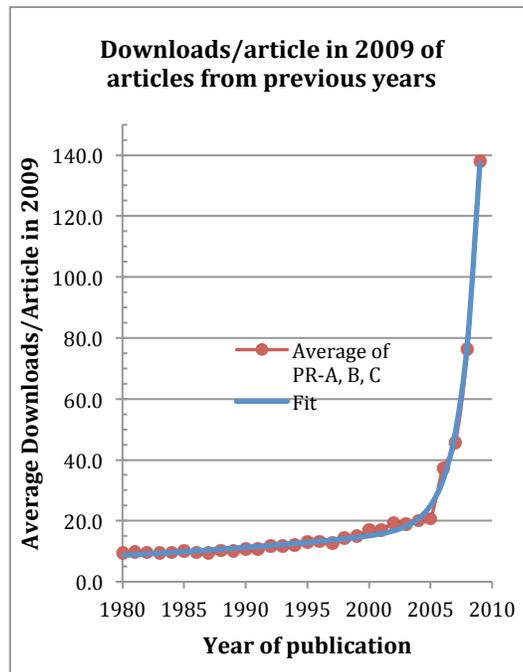


Figure 1. Downloads/article in 2009 of previously published articles, as a function of the year of publication.

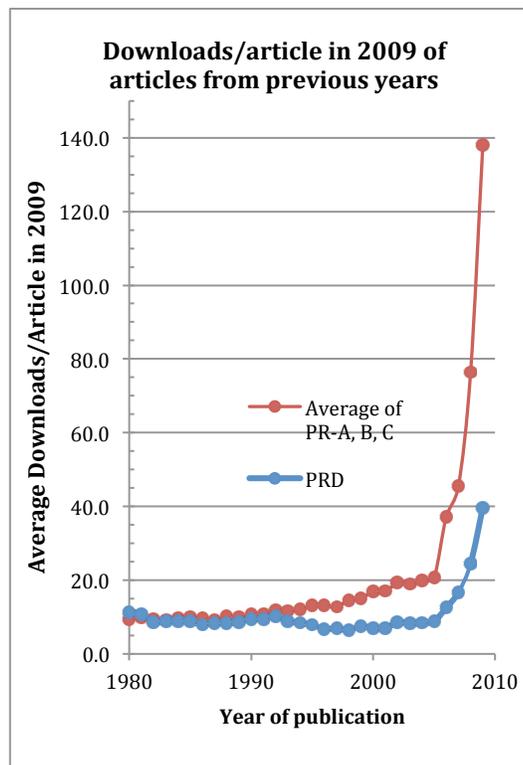


Figure 2. Same data as in Figure 1, with the addition of Physical Review D, a journal whose content is almost completely available on the arXiv.