

Reorganization of the APS Journals for the Era of Electronic Communication

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ABSTRACT

Electronic preprint distribution has fundamentally changed the role of scientific journals by providing immediate, widespread access to new scientific results. The APS journals should respond to this change as an opportunity to change their mission. In this note, I propose a new organization for the APS journals which would incorporate an electronic preprint archive, and which would allow the print journals to more effectively aid physicists in their use of scientific information.

The recent establishment of electronic preprint archives at Los Alamos National Laboratory has sparked new interest in the relation of preprints and archival journals as means of scientific communication. The mythology of the physics community is that new research results are validated by their appearance in an archival journal, and that preprints are informal reports, distributed for convenience, which should be discarded when the article is formally published. The reality, at least as I observe it in my subfield of high-energy physics, is quite different. Since the early 1970's, the preprint has been the major means for communicating new results. The appearance of the article in a journal serves more as a reminder or confirmation than as a new piece of information. The true primary function of the print journal, for me and my colleagues, has been as a convenient repository for results published some time ago.

The creation of electronic preprint archives is now producing a change in two aspects of this relation. First, the access to preprints is becoming more widespread. For many years, the high-energy physics community was one of relatively few subfields of physics having systematic preprint distribution. Now, anyone with a PC and an Internet address can receive papers deposited at Los Alamos. Second, the convenience of retrieving a paper electronically is approaching that of retrieving it from the library. We are now in the midst

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of a transition, but when this transition is complete, the electronic channel for distribution of scientific papers will have all of the technical advantages. What, then, would be the purpose of a journal? This is a question that we must think about seriously, and without prejudice for the current system.

In the following discussion, I will consider a journal to be an organized collection of scientific articles with an editor and a refereeing system. I will discuss it as if it were a print medium, though it could equally well be available electronically. I am one of those people who enjoys the feel of a book, and I am happy to curl up with a magazine if it is worth reading. But, today, nobody curls up with the *Physical Review*. I will address the question of what kind of journal scientists would read and find useful in an era which has allowed them immediate access to the unrefereed preprints.

In my discussion, I will often make reference to my own experience in reading and evaluating preprints. In these references, it is important to be aware that high-energy physicists have had organized preprint distribution, and a computer database of preprint authors and titles, for more than fifteen years, a sufficiently long time that this has become part of our culture. Our experience should be a preview of what other subfields will find when they begin to exchange preprints systematically.

Why does the scientific community need journals?

The most important service offered by journals is that of validation by refereeing. This validation has three distinct functions, which I will now review.

First, refereeing is an assurance to the reader of the article that this article has been looked at by an expert who has given it his or her approval. There are limitations to the extent to which a referee can vouch for a paper. The referee cannot redo calculations that have taken the author months of work, confirm the experimental results, or check the author's computer codes. However, the referee can perform a valuable service in criticizing the author's conceptual framework, in pointing out nontrivial consistency checks (especially if these are not passed), and in helping the author to make the article more clear. Unfortunately, this system is prone to breakdown. From one side, journals often publish incorrect papers, which we uncover in compiling bibliography, in answering our student's misconceptions, and in refereeing new papers based on these results. Journals eliminate papers which are obvious nonsense (and some which are merely controversial), but beyond this level I do not consider a paper published in the *Physical Review* more trustworthy than a random preprint. From the other side, the relationship between author and referee contains a tension that easily turns it into a contest of wills of no benefit to the eventual reader.

Refereeing also has another function, one which is often overlooked but which, to my mind, is even more important. This is in aiding readers to manage the overwhelming flow of scientific information. No physicist today could read and understand each of the 100 papers produced each week in high-energy physics, much less have time to learn about developments in other fields of science. In order to know what to read in a particular field, one must be an expert. As a result, most working physicists defend their time by increasingly microscopic

specialization. Journals cannot stem the flow of information, because a paper rejected from one journal will usually appear in another, and, more emphatically, because even a result presented in a preprint has been made public. Already, the usage in the high-energy physics community is that one is obligated to assign credit and scientific priority to results that have appeared in preprints. Still, a journal could aid its readers in making value judgments, by being selective in favor of articles that have original and interesting ideas. Unfortunately, the APS journals do not have a useful impact along these lines. The *Physical Review* makes no effort that I can detect to select articles that are interesting from those that are merely correct. *Physical Review Letters*, of course, does attempt to select papers on the basis of interest. Though I cannot judge this selection in other fields, I find the results in high-energy physics to be completely unsatisfactory, due to the other peculiar features of this journal. This case is discussed in more detail below.

The third function of refereeing is as a service to the author, who will call attention to his publications in ‘refereed journals’ as a qualification for professional advancement. This service makes sense only if the services of refereeing to the reader, as discussed above, are working correctly. Today, a typical assistant professor candidate will have 50 papers published in refereed journals. Everyone recognizes that this candidate should be judged on their two or three papers that have had a sizable impact on the field, but it is very difficult to identify these papers or to appreciate their value. On the other hand, the importance for one’s career of publishing papers exacerbates the intrinsic strains in the relation between author and referee and makes it more difficult for the referee to act as an advocate for the reader.

These three functions of refereeing are of great importance to the physics community. We must admit that they do not work very well. I will now argue that the preprint culture and the use of electronic preprint archives gives us an opportunity to create a system in which refereeing can be more effective.

Principles of a reorganization of the APS journals

An electronic system of preprint distribution would remove the need for a print medium simply to archive and retrieve scientific results. It follows from this that not every scientific paper need receive the careful attention from editors and referees now given to a journal article. I propose that the APS replace the current system of journals publishing new research results with a system structured along these lines.

The APS journals publishing new research results should be replaced by a two-tiered system. The first level would be an electronic preprint archive which would accept any paper submitted, without refereeing. This archive would regularly announce new submissions electronically. The second level would be a refereed archival journal, the *Physical Review*. Papers submitted to the electronic archive would be nominated for publication in the journal by the users of the electronic archive, and acceptance of these nominations would be selective. All three aspects of this system will be described in more detail below.

At the moment, the APS publishes only one review journal, *Reviews of Modern Physics*.

In my opinion, *Reviews of Modern Physics* works well at the task it has assigned itself, publishing comprehensive review articles and large-scale tutorials. However, there is a need for an interdisciplinary journal of brief reviews, a need recognized in the most recent redefinition of the mission of *Physical Review Letters*. In my proposal, *Physical Review Letters* would be eliminated in favor of a new journal whose sole purpose would be to provide brief reviews of the literature. This new journal is also described below.

I will now fill in this outline with more detailed descriptions of the components of this plan.

The electronic archive: The criteria for the electronic archive are straightforward, involving infrastructure which already exists for the Los Alamos bulletin boards. Authors would submit papers as file in PostScript (or an alternative graphical language), or in TeX or another medium that could be converted to PostScript. Alternatively, it should be possible to submit hard copy to the APS which would then be scanned into PostScript format. All papers meeting minimal formal criteria would be accepted. Authors would assign their papers a subject area and possibly cross-reference areas. Authors would submit a title, author list, and abstract which would be entered into an electronic database and also would be announced by e-mail to subscribers to the corresponding subject area.

Both the archives themselves and the electronic database should be available for query and information retrieval over the Internet, perhaps through WWW. The database, which should allow searches by title, author, and keywords, is an essential component of this system and should be as friendly as possible. The SPIRES preprint database compiled by the SLAC library offers all of these features today for high-energy physics preprints; it also allows searches by citation.

Once a paper is submitted, it should remain in the archive indefinitely. The most recent papers should be retrievable by return e-mail; for papers more than five years old, a 1-day turnaround for retrieval should suffice. Authors should be allowed to freely modify their submitted papers for the first week after submission, to correct errors in the text and formatting, but after this grace period the integrity of the document should be protected and the author's corrections limited to appended notes. This will be essential to deter premature publication and to resolve questions of scientific priority. One might wish to provide facilities to allow other archive users to comment on the paper, attach cross-links, *etc.* Full discussion of this last point would lead us too far afield.

The refereed journal: The refereed journal should be quite similar in format to the present *Physical Review*. The size of the journal would be restricted by the editors to be about 20% of the size of the current *Physical Review*. Papers of letter as well as normal article length would be included. Papers would be selected through a nomination process. Once a paper is selected, it would be sent to one referee for expert review. However, the presumption of this review will be that the paper will be published unless it is demonstrably incorrect. An important role of the referee will be to improve the clarity of the paper, so that, when it is published, it is as useful as possible to the reader. By moving the selection process to a different stage, this mechanism allows the refereeing process to be cooperative

rather than adversarial.

The crucial new step in publication would be the nomination process. In principle, this could be done by a committee of elders, but this would create a burdensome new position whose holders would come under constant criticism for elitism. Instead, I propose that this selection be done by general membership of the physics community as we engage in our everyday tasks of reading the preprint literature and choosing papers that would be valuable for our research. When a physicist encounters a paper that should be of continuing value, he or she would write a note to the Editor of the relevant section of the *Physical Review*, explaining briefly the contribution and significance of this paper which justifies its inclusion in a special archive. The Editor would then select papers based on these comments, and the signed comments would be published along with the paper as a guide to the reader. The statistics on the number of citations to the paper or the number of requests for it from the preprint archives might assist in the selection of papers, though it should not become the primary basis of selection. While the Editors of the *Physical Review* today deliberately do not intervene in the arguments between authors and referees, I infer from their skill in selecting referees that they would be able to make valid judgments based on submitted nominations. The possible abuses of this system would be controlled by the published comments; it will soon be clear to the Editor and to the community if A and B are constantly touting one another's work.

Although most recommended papers will be new preprints, there is no reason why a preprint submitted years before should not be recommended for inclusion in the journal. It is not uncommon that a particular calculation or experimental result is ignored for a long time before its significance is understood. In the present system, that article would usually be published but then buried in the mountain of literature, and if it is not published, it would be lost completely. In the system I propose, this paper would at least reside in the electronic archive and database until someone makes the connection that demonstrates its importance and, after that, it can be brought back into a more public forum.

To conclude this section, I restate the basic principle of the reviewing system proposed: It is much easier for a journal to be selective about its contents when the selection process is positive rather than negative. The same physicist who, as a referee, would be unwilling to harm the career of A by rejecting his paper, would be happy to pass over this paper in favor of a much more interesting paper on a similar subject written by B. If this judgment is announced along with an expert's summary of the significance of B's work, the community has obtained a double benefit in understanding what scientific progress has been made.

The new review journal: In addition to archiving new research results, the physics community needs a guide to the literature with a broader perspective than that of a single research article. To a certain extent, this function is filled by the major review articles published by *Reviews of Modern Physics* and *Physics Reports*. However, it is a weighty task not only to write such major reviews but also to read them. Thus, these reviews are useful when one goes to study a new problem seriously, but not to keep up one's general knowledge of physics. A journal of brief reviews would be valuable in filling this gap. Such a

review would be addressed to general members of a subfield (for example, to all theoretical and experimental high-energy physicists); written at this level, it would also be useful to physicists from other subfields. It would be structured either as a pedagogical review of a specific problem or as an argument for one viewpoint on a question under debate in the literature. In exceptional cases, such as the recent announcement of evidence for the top quark, it would provide a brief account of the discovery together with background material. Such a review should also provide bibliography for further study. Much of this bibliography would be citations to the preprint archive. In fact, the journal should restrict its citations to material already available to the reader, rather than using this medium to announce new results. To make these reviews easy to write, and to keep them topical, a restriction to letter length would be quite reasonable. This motivation recalls the original purpose of *Letters to the Editor of the Physical Review*, and I propose this as the name of the new journal. In my scheme, this journal would replace the current *Physical Review Letters*. Its size would be roughly the same, and its articles would be of the same length.

As compared to the current *Physical Review Letters*, the new journal would be less prestigious but much more useful. It would be more useful because its articles would be written specifically to inform the reader rather than to be the first presentation of new results. This feature would retain for the new journal *Physical Review Letters*' large base of individual subscribers. It would be less prestigious because it would be a review journal and would make no claim that the results presented are original to the author. Publication in *Letters to the Editor* would still be coveted to some extent because this should remain the most widely circulated of the APS journals. But the pressure to publish in *Letters to the Editor* should be much reduced from the current pressure to publish in *Physical Review Letters*. *Articles submitted to Letters to the Editor* would be selected by an Editorial Board of working physicists, who could also commission a review from an expert on a particular problem of interest. These articles would then be refereed for content and clarity. The Editor would oversee this process to discourage self-serving advertisement and debate on priority while encouraging genuine debate on scientific questions.

The intent of this system is that the credentialing aspect of the refereeing process be transferred from *Physical Review Letters*, where it is actually counterproductive, to the *Physical Review*. In this way, the APS journals will promote the presentation of research results as substantive articles rather than in abbreviated format. At the same time, the role of *Physical Review Letters* in providing a forum for discussion of physics across subfields within a single journal will be enhanced by promoting articles which serve the readership.

What steps should we take now to implement this plan?

The plan that I have set out assumes the existence of an electronic preprint archive which covers the fields represented in the *Physical Review*. A first step, then, would be to make this archive available. Along with this step, those subfields of physics that have not had organized preprint distribution will begin to appreciate the advantages of communication through preprints. This will set up the foundation that would make the rest of the system possible.

For those fields that have electronic preprint distribution through the Los Alamos bulletin boards, it would be appropriate to set up now a new category of article in the various sections of the *Physical Review* whose selection would be organized along the principles discussed above. Thus, each letter section of the *Physical Review* could contain a set of articles labelled ‘Selections from the Network’. Publication in this group of articles would be prestigious, because it is selective, and thus would attract the interest of the community.

As a further step, the APS should eliminate *Physical Review Letters* and replace it with the *Letters to the Editor* journal described above. The original motivation for *Physical Review Letters*, that of providing a channel for rapid dissemination of the most important new ideas, has been made completely obsolete by widespread preprint distribution. Today, the main motivations for publication in *Physical Review Letters* are its prestige value and its scope across the subfields of physics. The prestige of *Physical Review Letters* is counterproductive, since it forces authors to compress their articles beyond comprehensibility to fit the journal’s page limit. In my community, the compression effect drives the most important theoretical papers to other journals, while papers which do appear in *Physical Review Letters* tend to be simple phenomenological estimates or small theoretical extensions of known results. The most interesting papers are usually pieces of a serial publication. In experimental high-energy physics, on the other hand, the prestige value drives papers into *Physical Review Letters*, at whatever cost. It is not uncommon that the four-page paper in *Physical Review Letters* is the only announcement in a refereed journal of a result that required a \$20 million detector and tens of man-years of effort to achieve. The full documentation of the experimental measurement can then only be found in Ph.D. theses and conference reports, and often these are of limited archival value. In either case, the brief papers can be understood only by specialists.

Despite this, I do appreciate the broad scope of *Physical Review Letters*. I regularly peruse the Table of Contents looking for interesting results in other subfields. However, I rarely even try to read the articles. Instead, I use these articles as a source of bibliography back to the review paper or longer article that I can use as an appropriate introduction to the topic discussed. If this were made the main mission of *Physical Review Letters*, instead of one completely subsidiary to that of prestige publication, this journal might become a useful tool for APS membership. It might, in fact, be read, or even curled up with, rather than simply consulted.

In this article, I have described a proposed reorganization of the APS journals for the era of electronic preprint distribution. The changes I have proposed have little to do with the properties of the new electronic media. Rather, they are a long-overdue response to the use of the preprint as a medium for scientific exchange, a practice which is already part of the scientific culture. The service that working scientists require from their scientific literature have changed from those of fifty—or even twenty—years ago. This restructuring of the APS journals addresses those changes, and would restore these journals to their necessary, valuable role.

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