

The cost of physics journals

Prices that libraries pay for subscriptions vary widely among journals; for physics and mathematics publications the cost per character varies by as much as a factor of 40.

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Science libraries all over the United States face serious financial problems associated with the increased costs of journals.

At the University of Wisconsin in Madison, where I teach, the physics library has had to cancel its subscriptions to many physics journals—subscriptions that began in most cases when the journals first started publication. The other science libraries at the university are in a similar situation. The reason is that the cost of serials (including some books in series, such as *Annual Reviews*) increased by 32% from fiscal 1985 to fiscal 1986. In the three preceding years the cost of subscribing to these serials had increased by an average of 4% per year—amounts that the library budget could readily accommodate. Recent variations in the foreign-exchange rate are mainly to blame: For several years the

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cost in US dollars of foreign journals had remained fairly constant—in some cases even decreased—but this year the US dollar prices of some foreign journals increased dramatically; for example the cost of *Journal de Physique* increased by 69% and that of *Hyperfine Interactions* by 71%.

Library budgets

When science librarians try to justify their budgets, the question that often arises is why physics and chemistry journals are so expensive compared with journals in the humanities. A survey published¹ in 1985 reported that the average price of a physics journal was \$328 per year, while the average price of a philosophy journal was \$47 per year.

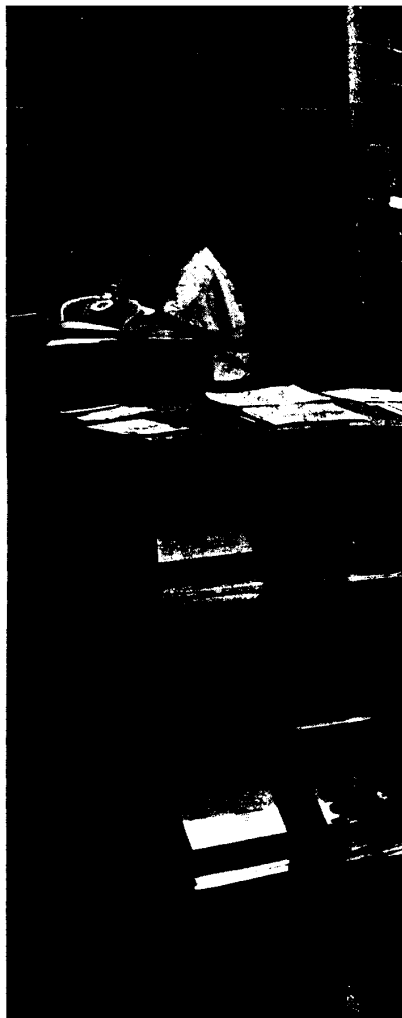
One possible reason for this difference is the higher cost of producing the mathematical and other technical materials in physics and chemistry journals. Another explanation might be that more libraries, such as public libraries and undergraduate college libraries, are likely to subscribe to

humanities journals than to physics journals. Although both these factors undoubtedly affect the cost, they don't appear to be the most important cause of the difference.

Recent survey results suggest that the differences between the costs of physics journals and journals in the humanities arise mainly from the differences in the number of pages published. A similar finding emerged from a study four years ago. In an article in *PHYSICS TODAY* (October 1982, page 43), Donald W. King and Nancy K. Roderer reported that physics journals published on the average twice as many pages annually as other science journals, and they concluded that this was the principal reason that physics journals have higher subscription prices than journals in the other sciences.

Journal surveys

In 1983 the American Mathematical Society made² an extensive survey of the 1982 cost per 1000 characters for various mathematics journals published in the United States. This sur-





Physics journals in the physics library at the University of Wisconsin, Madison. The high cost of physics journals is forcing librarians around the country to cut back on subscriptions.

vey yielded cost estimates ranging from 0.8 cents for the *Journal of the American Statistical Association* to 35 cents for *Applicable Analysis* (Gordon and Breach, New York); that is, the cost varied by a factor of more than 40.

At the University of Wisconsin, we decided to make a less complete survey of physics and philosophy journals, but included journals published outside the United States. We did not include translation journals. All our data are for 1985, the last year for which we had information about the number of pages published. In most instances we based the cost on the nonmember (library) subscription price printed in the journal (unless a discount is given to all US subscribers); if no dollar price was printed in the journal, we used the price paid by the library. The prices did not take into account discounts available for multiple subscriptions or fees charged by subscription agents.

In determining the number of characters per page we followed the same procedure that was used in the 1983 AMS survey of mathematics journals;

that is, we counted the number of characters in some lines of text without mathematics and multiplied by the maximum possible number of lines of text on a page. The number of pages per year was taken to be the number of numbered pages. While there are variations in the numbering of pages and in the number of blank spaces or blank pages, these variations have little impact on the final estimates. Although the estimates have considerable uncertainty, even a 20% error does not affect the principal conclusions.

Soon after we completed our survey of physics journals in general, the Optical Society of America prepared³ a study of the 1984 optics periodical literature that overlapped our survey. Their conclusions are similar to ours.

Survey results

The table on page 36 lists results for a sample of the journals from each survey. Among the physics journals in our survey, we picked at random one or two journals published by each of the major physics publishers. Among the jour-

nals in the Optical Society study, and from the philosophy and mathematics journals, we selected the lowest- and highest-priced journals published by not-for-profit and by commercial publishers.

While one would expect journals published by not-for-profit publishers to be less expensive than those published by commercial publishers, the cost-per-character ratio of over 40 between the most expensive commercial and the least expensive not-for-profit publication is larger than one might have expected. We found the variation to be similar for mathematics and physics journals. An unexpected finding was that the average cost per character is about the same for physics and philosophy journals; subscription prices for philosophy journals are much lower because they typically publish far fewer pages, of generally smaller size.

As mentioned earlier, the number of subscriptions sold to libraries must affect the subscription price. The impact of circulation on subscription

Cost of Journals

Journal	Publisher	Library subscription (dollars/year)	Cost per 1000 characters (cents)
Physics (author's survey, 1985)			
Journal of Applied Physics	AIP	450	0.7
Physical Review B	APS	740	0.7
Physical Review Letters	APS	365	1.0
Applied Physics Letters	AIP	260	1.6
Vacuum	Pergamon	170	3.4
Journal of Physics A	Inst. of Physics	470	3.8
Zeitschrift für Physik A	Springer-Verlag	502	4.5
Physics Letters A	North Holland	717	4.6
Molecular Physics	Taylor & Francis	860	5.8
Nuclear Physics A	North Holland	2189	5.9
Annals of Physics (New York)	Academic Press	756	8.3
Physique Théorique	Gauthier-Villars	108	9.0
Journal of Mechanics and Physics of Solids	Pergamon	200	9.2
Foundations of Physics	Plenum	395	12
Particle Accelerators	Gordon & Breach	260	31
Optics (OSA survey, 1984)			
IEEE Transactions on Electron Devices	IEEE	70	0.4
Optics Letters	OSA	115	2.5
Spectrochimica Acta B	Pergamon	300	3.5
Journal of Raman Spectroscopy	Wiley Heyden	445	13.5
Mathematics (AMS survey, 1982)			
Journal of the American Statistical Association	Am. Stat. Assoc.	50	0.8
Communications on Pure and Applied Mathematics	Wiley	115	3.6
Theory of Probability and Mathematical Statistics	Am. Math. Soc.	180	14.8
Applicable Analysis	Gordon & Breach	361	35.0
Philosophy (author's survey, 1985)			
Reviews of Metaphysics	Catholic U.	32	1.3
British Journal of Aesthetics	Oxford U. P.	50	3.7
Archiv der Geschichte und Philosophie	de Gruyter	39	4.0
Philosophical Investigations	Blackwell	66	8.0

prices cannot be easily analyzed, however, because few commercial publishers release circulation figures, and those that do give only approximate figures. The ratio of 19 between the cost of *Theory of Probability and Mathematical Statistics*, which has a circulation of 246, and that of the *Journal of the American Statistical Association*, which has a circulation of 18 500, can be readily understood. On the other hand, the cost ratio of 12 between *Annals of Physics*, which according to the publisher has a circulation of 1100, and *Physical Review B*, which has 2400 nonmember subscribers, must be due to other causes.

The most obvious explanation is that *Physical Review B* requests the payment of page charges, while *Annals of Physics* does not. This was indeed an important factor in the past. Page charges were introduced in 1932 by The American Physical Society to reduce subscription prices and to increase the circulation of its journals. Originally the page charge was \$2 per page; it peaked at \$85 per page in 1982, and is now \$25 per page. The decision to reduce reliance on page charges was made in response to authors' objections to paying them. Some authors prefer to publish in journals that do not have page charges so that they can use their research funds for other purposes, and others work in countries that have

currency-exchange restrictions or other regulations that prohibit the payment of publication charges. In addition, the general availability of photocopying has made wide circulation much less important.

Page charges accounted for just 15% of the 1985-86 APS journal budget and only 10% of AIP's archival-journal budget in 1985. Hence page charges no longer have a large impact on the cost of journals published by AIP and APS, although such charges continue to provide about half the expenses for the journals published by the American Astronomical Society and by the American Geophysical Union.

Although the payment of page charges has always been voluntary, most authors (typically 80%) pay the charges because they feel that they should contribute to the cost of publishing their research. Now that AIP and its member societies have either reduced page charges or eliminated them entirely—*American Journal of Physics*, *Journal of Mathematical Physics* and *Review of Scientific Instruments* no longer request page charges—the cost to the author should no longer be a serious obstacle to submitting papers to these journals.

Library perspective

Libraries benefit greatly from the low cost per printed word of journals

published by AIP and its member societies. These journals also have larger circulations and wider readerships than commercial journals, not only because they have more library subscriptions but also because AIP and several of its member societies offer society members personal subscriptions at sharply reduced rates that generally cover only printing and distribution.

As chairman of our physics department's library advisory committee, I have the unpleasant task of advising our librarian on which journal subscriptions to cancel. Obviously the most important considerations are how many people use the journal and whether the journal is available elsewhere on the campus. But I also look at cost, and my opinion is influenced not only by the price of the journal but also by the price per printed word.

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1. R. T. Lenzine, *Serials Librarian* 9(4), 119 (1985).
2. *Notices Am. Math. Soc.* 30, 715 (1983).
3. *Price Comparison Study of 1984 Optics Periodical Literature*, prepared for the Optical Society of America. □