AIP STYLE MANUAL

Fourth Edition

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Preface

The American Institute of Physics published its first *Style Manual* in 1951. It was produced at the request of the Publication Board, which was made up of the editors of all Member Society journals, and with their approval.

At that time there were five Member Societies, each publishing one or two journals through the services provided by the Institute. Now there are ten Member Societies, which between them publish about forty archival journals and seven translated journals. In addition, AIP itself now has a publishing program that comprises seven archival journals, eighteen translated journals, and two magazines.

Roughly half of the Member Society journals are still produced through AIP's publishing services, as are all of AIP's own publications. But the remainder are published by their Member Society owners independently of AIP's copyediting and composition facilities.

The 1951 *AIP Style Manual* was followed by a second edition in 1959 and a third edition in 1978. This year, in the fourth edition, the emphasis is changing. The *Style Manual* is no longer tied closely to the procedures followed in the AIP journal production offices, but instead attempts to accommodate the different style rules and procedures practiced throughout the AIP "family" of journals. It presents advice which, if followed, should result in the preparation of clear, concise, and well organized manuscripts eminently suitable for submission to any physics or astronomy journal editor's office.

At the time of the third edition (1978) the text pages of many AIP and Member Society journals were composed by typewriter, because the monotype composition used earlier had become too expensive. Since then practically all journal pages have been produced by computer-controlled photocomposition, and at the present time a second generation of computer typesetting systems is coming into use. The next steps, which will be made possible by this new typesetting technology, will include the easy transfer of authors' own digitized text files to the publisher's composition system without rekeyboarding, and, eventually, the production of complete "electronic pages" that can be stored on disks or transmitted by telephone line.

Given the accelerating march of new publishing technology, it appears probable that the next edition of the *AIP Style Manual* will have to follow this one at a closer interval than has been the case with the previous editions.

The number of members of the AIP staff and of the Publication Board, both past and present, to whom the Institute is indebted for their various contributions to this Manual is so great that it would take another section to name them all. Instead, therefore, a hearty "Thank you" to all of you from today's AIP and Publication Board.

Robert T. Beyer
Chair, AIP Publication Board

I. Summary information for journal contributors

A. MANUSCRIPT PREPARATION

The information on this and the following page is a summary of the advice given in detail in later sections of the manual. Authors should note in addition that the journal for which they are writing may have particular requirements that differ in detail from those presented here. Consult the "Information for Contributors" page in the selected journal. In general, a study of the form and style of published articles is the best guide to the requirements of individual journals.

1. General instructions

Manuscripts must be in English (American usage and spelling), typed or printed double spaced throughout, on white paper preferably 215×280 mm (8½×11 in.) in size. Use one side of the page only, leaving wide margins at both sides and at top and bottom. Indent paragraphs. Number all pages consecutively, beginning with the title and abstract page. Submit the original manuscript with production-quality figures and one or more duplicate copies (including clear copies of figures), as required by the editor of the journal to which the manuscript is submitted. Manuscripts that cannot be read or easily understood will be returned to the author.

Include the following material, in the order shown:

a. title, with the first word capitalized,
b. authors' names,
c. authors' affiliations, including adequate postal addresses,
d. abstract, preferably on the first page with the title,
e. appropriate indexing codes selected from the Physics and Astronomy Classification Scheme (see Appendix I),
f. text,
g. acknowledgments,
h. appendixes (if necessary),
i. collected references in the order in which they are cited,
j. tables, each with a caption,
k. collected figure captions,
l. figures,
m. if necessary, supplementary material for deposit in AIP's Physics Auxiliary Publication Service (see Appendix J).

Ask someone else to read the manuscript, however satisfied you may be with its clarity and accuracy. A second pair of eyes can often find a typographical error or unclear statement that the author missed.

2. Abstract

An abstract must accompany every article. It should be a concise summary of the significant items in the paper, including the results and conclusions. In combination with the title it must be an adequate indicator of the content of the article, because it will appear separated from the text and illustrations in electronic bibliographic databases and printed abstracting journals. For this reason the abstract should not contain literature citations that refer to the main list of references attached to the complete article, nor allusions to the illustrations. Define all nonstandard symbols and abbreviations. Do not include tabular material or illustrations of any kind. Avoid "built-up" equations that cannot be rendered in linear fashion within the running text. Type or print the abstract double spaced, preferably as a single paragraph. It should be about 5% of the length of the article, but not more than about 500 words.

3. Mathematics

Type or print as much of the mathematical material as possible. Handwritten material must be neatly lettered in black ink. When confusion is possible, distinguish between similar-looking letters, numbers, and special symbols when they first occur [for example, the number "one" (1) and the letter "ell" (l); the Roman letter "kay" (k) and the Greek letter "kappa" (κ); the "proportional to" symbol ($\propto$) and the Greek "alpha" (α), and so on]. Write the identification of these symbols in the margin where they first occur.

Notation should be clear, as simple as possible, and consistent with standard usage. Display all numbered equations on separate lines set off from the text above and below. Consecutive numbering of equations throughout the text is generally preferred, in which case use arabic numbers in parentheses flush right with the right margin. In some journals, numbering by section may be permitted, with the section number made part of the equation number.

4. Footnotes and references

Type or print all footnotes (including references) in order of citation as a separate double-spaced list at the end of the manuscript, before the tables and figures. Start with footnotes to the title, authors' names, and authors' affiliations; for these, some journals use a sequence of letter superscripts, some use a series of symbolic indices (asterisks, daggers, etc.). Check a recent issue of the journal to which the paper is to be submitted for the correct form. Acknowledgments of financial support should be made in the acknowledgments section of the paper, not as footnotes to the title or to an author's name. For literature references in the body of the paper, most AIP and Member Society journals prefer to number them in order of appearance and list them in that order at the end of the article. (Some journals will also permit references to be cited in text by author and year only, with the reference list arranged alphabetically by author's name; see Sec. II C 10 for a more complete discussion.) In the usual case, where literature citations are numbered, use superscript arabic numerals appearing in consecutive numerical order through the text. The names of authors in the reference list should be given in the form in which they appear on the title page of the cited work, with the family name ("surname") last. For journal references use the standard abbreviations for journal names given in Appendix G; give the volume number, the first page number, and the year of publication. For model footnotes and references see Table II.

5. Tables

Tabular material more than four or five lines long should be removed from running text and presented as a separate table. Type each table double spaced on a separate page after the list of footnotes and before the collected figure captions. Use roman or arabic numerals, according to the usage in the selected journal. Be sure to cite every table in the text. Each table must have a caption that is complete and intelligible by itself without references to the text. Column headings should be clear and concise, with appropriate units. Type or print a double horizontal line below the caption, a single line below the column headings, and another double line at the end of the table. For footnotes to a table use the sequence of letters a, b, c, etc., with a new sequence for each table. Place the footnotes themselves below the double line at the end of the table. For a model table, see Table III.

6. Figures and figure captions

Number figures with arabic numerals in order of appearance in the text; be sure to cite every figure in the text. Give every figure a caption, complete and intelligible in itself without reference to the text. Type or print the list of captions double spaced on a separate page or pages at the end of the manuscript. Place the figures themselves in sequence after the collected captions. Write the figure number and authors' names at the bottom of each figure; if it is necessary to write on the back of a photograph, write very lightly with a soft pencil. Indicate the orientation required if it is not obvious from the content.

To protect figures against damage in transit, make them no larger than 215×280 mm ($8\frac{1}{2} \times 11$ in.); mail them flat, well protected by stiff cardboard. In general, figures should be planned for reduction to the journal column width. Line drawings are best made with India ink on Bristol board, thick smooth paper, or high-quality tracing cloth. Use white material only, with lines solid and black. Draw symbols and letters so that the smallest ones will be not less than 1.5 mm (1/16 in.) tall after reduction; the largest lettering should not be out of proportion. Avoid gross disparities in the thicknesses of lines and in the sizes of symbols and letters. Do not handletter; use a stencil or other mechanical device instead. Submit original line drawings or high-quality glossy photographic prints.

Increasing use is being made of computer-controlled plotters in the preparation of line drawings. While these devices can make excellent drawings for reproduction, they often produce lines that are too fine and data points that are too small to survive reduction. Lettering produced by the plotter must meet the same standards as those on conventionally drawn illustrations. Photographs should be printed in high contrast on glossy paper. Most journals can publish colored illustrations when the color is an important feature of the scientific content; contact the editor to determine any special requirements of the specific journal.

7. Physics Auxiliary Publication Service

Material that is part of and supplementary to a paper, but of too limited interest to warrant full publication in the journal, should be prepared for deposit in AIP's Physics Auxiliary Publication Service and submitted with the paper. Examples are copious data tables, detailed spectrum plots, and code for computer programs. See Appendix J.

B. PROCEDURES AND CORRESPONDENCE

1. Correspondence before acceptance

Submit manuscripts directly to the journal editor. Specify in the covering letter which author and address, if there are several, is to be used in correspondence.

All manuscripts submitted to journals published by AIP or its Member Societies are subject to anonymous peer review. The editor chooses the referees and makes the final decision to accept or reject the paper. Most manuscripts are returned to their authors for revisions recommended by the editor and referees. Thus it will typically take some months for a paper to be finally accepted. Accompanying the notice of acceptance may be a form which, when signed by the author, transfers the copyright of the written work to the journal owner (AIP or Member Society). The Transfer of Copyright Form should be properly completed and signed; in most journals your paper cannot be published without it. There may also be a Publication Charge form on which the author (or a representative of the author's institution) certifies whether or not the publication charge will be honored, and a form for ordering copies of reprints.

2. Correspondence after acceptance

After a paper has been accepted, send correspondence about all editorial matters to the office indicated in the notice of acceptance. In all correspondence, reference must be made to the journal name (several journals may be produced in the same publishing office), the title of the paper, the authors (emphasizing first author's last name), and the scheduled date of publication.

3. Proofs

For those journals typeset by AIP, proofs are sent from the Composition area directly to the author, and should be returned promptly, after correction, to the Managing Editor of the journal in question. Extensive changes from the original are costly and may delay publication while being reviewed by the editor. Authors may be charged for the expense of making extensive changes in proof.

II. Preparing a scientific paper for publication

A. WRITING THE PAPER

No two scientific papers are sufficiently alike that any tidy group of fixed rules for writing a scientific paper could apply to all papers with inevitable success. It is possible, however, to state principles and offer suggestions that will encourage any author to present a body of scientific information in a reasonably smooth and coherent form. We present the following guidelines in this spirit and with a conscious effort to help the novice.

1. Before beginning to write

Despite the natural tendency to feel that no work is being done on a paper if no actual writing is under way, adequate preparation can help ensure a logical, readable product and shorten the writing time. Preparation can follow these steps.

(1) Analyze the problem. Ask yourself at least these four questions:

(a) Exactly what information do I wish to present in this paper?
(b) For what specific group of readers am I writing?
(c) What background information can I assume these readers have?
(d) What is the most logical sequence in which I should present the information to the readers?

(2) Make a detailed outline. The outline will serve as your writing guide; therefore, make as many subdivisions as possible. It is easier to eliminate or combine existing subheadings than to insert new ones. As you write, you will, almost certainly, revise the outline. Even if the outline suffers drastic revision before the paper is finished, the very act of preparing and modifying it serves as a mental stimulus that goes far toward ensuring logical development of the subject matter. Be sure your outline reflects the true structure and emphasis you wish your paper to have. Remember that many hurried readers will scan the headings and subheadings to determine if they need to read the entire text; try to help them by making the headings informative and logical.

(3) Plan tables and figures. You may already have thought about the tables and figures while preparing the outline, but if not, do it at this stage. Some data lend themselves to presentation in tabular form; others do not. Appropriate figures can be very valuable, but there are times when a few good sentences convey more information than a drawing or photograph. Avoid unnecessarily duplicating data in tables and figures. Select the form of presentation—tables, figures, or text—with the efficient presentation of your data as the only criterion.

(4) Sit and think. This step should precede, follow, and be interspersed with the others. In other words, do not try to rush through the entire process in one continuous effort, but continually stop and review what you have done and think again about what is to come.

2. General rules for writing

The following rules can be applied with profit to all technical writing and to all parts of a scientific paper. For specific points of style, see Sec. III.

(1) Be clear. Consider the beauty and efficiency of the simple declarative sentence as a medium for communicating scientific information. Use it freely, but not exclusively. Avoid long, meandering sentences in which the meaning may be obscured by complicated or unclear construction.

(2) Be concise. Avoid vague and inexact usage. Be as quantitative as the subject matter permits. Avoid idle words; make every word count.

(3) Be complete. Do not assume that your reader has all the background information that you have on your subject matter. Make sure your argument is complete, logical, and continuous. Use commonly understood terms instead of local or highly specialized jargon. Define all nonstandard symbols and abbreviations when you introduce them. On the other hand, omit information unnecessary for a complete understanding of your message.

(4) Put yourself constantly in the place of your reader. Be rigorously self-critical as you review your first drafts, and ask yourself "Is there any way in which this passage could be misunderstood by someone reading it for the first time?"

3. English as a common language

(1) Scientists whose native language is English are fortunate that so much of the world's scientific literature is in English, and that so many members of the international science community have accommodated so well to this fact. Nevertheless, they should be aware that their papers will be read by those to whom English is a foreign language. Complex sentence structure and regional idiomatic usages will tend to obscure the meaning. Although AIP journals employ American spelling and usage, some American idioms (such as "ball-park figure," to cite an extreme example) are not universally understood. "International English" may be colorless by literary standards, but it is understandable by the largest number of readers.

(2) Those whose native language is not English need to be particularly careful to make sure their manuscripts are clearly and grammatically written before submission. Whenever possible, ask someone who is a native English speaker, and who has at least some knowledge of your subject matter, to read the manuscript in draft form and comment on the writing style. Having a good knowledge of the technical terminology and being able to read written English does not guarantee the ability to write accurate English. The proper use of definite and indefinite articles, and the proper choice of prepositions, are notorious examples of English writing style that non-English speakers find difficult. Nonnative English speakers may not even be aware, solely from their experience as readers of well-written English texts, of the nuances they need to observe when they turn to writing English themselves. Editors and referees will, in general,

make every effort to judge the scientific content of a paper without being negatively influenced by poor English style, provided the errors are not bad enough to obscure the meaning. In extreme cases, however, papers must be returned to their authors for rewriting by a native English speaker before they can be reviewed.

4. The introduction

Every scientific paper should have at least one or two introductory paragraphs; whether this introduction should be a separately labeled section depends upon the length of the paper. Paradoxically, although it appears first it should be written last. You will probably find it easier to start writing the introductory text after you have written part or all of the main body of the paper; in this way, the overall structure and content are more easily seen.

The first sentence of the paper is often the most difficult to write. It is important enough, however, to deserve considerable time and attention. The first sentence and the first paragraph play a critical role in determining the reader's attitude toward the paper as a whole. For best results, be sure to:

(1) Make the precise subject of the paper clear early in the introduction. As soon as possible, inform the reader what the paper is about. Depending on what you expect your typical reader already knows on the subject, you may or may not find it necessary to include historical background, for example. Include such information only to the extent necessary for the reader to understand your statement of the subject of the paper.

(2) Indicate the scope of coverage of the subject. Somewhere in the introduction state the limits within which you treat the subject. This definition of scope may include such things as the ranges of parameters dealt with, any restrictions made upon the general subject covered by the paper, and whether the work is theoretical or experimental.

(3) State the purpose of the paper. Every legitimate scientific paper has a purpose that distinguishes it from other papers on the same general subject. Make clear in the introduction just what this purpose is. The reader should know what the point of view and emphasis of the paper will be, and what you intend to accomplish with it.

(4) Indicate the organization of the paper when its length and complexity are great enough. Short papers should have an obvious organization, readily apparent to the casual reader; long papers, however, can benefit from a summary of the major section headings in the introduction.

5. Main body of the paper

Presumably, you tentatively decided on the form and content of the main body of your paper, which contains all the important elements of the message you want to convey, when you first decided to write the paper. Now review those decisions in light of the advice given above and write the sections that make up this part of your article. Then read through your first draft, asking yourself such questions as:

(1) Have I included all the information necessary to convey my message?

(2) Have I eliminated all superfluous material?

(3) Have I given proper emphasis to important ideas and subordinated those of lesser importance?

(4) Is the development of the subject matter logical and complete, free of gaps and discontinuities?

(5) Have I been as quantitative as I could in presenting the material?

(6) Have I made the best use of tables and figures, and are they well designed?

(7) Are the facts I have presented adequate to support the conclusions I intend to draw?

Now revise the first draft of the main body of your paper in the light of your answers to these questions and others that occurred to you as you read the draft.

6. The conclusion

Typical functions of the conclusion of a scientific paper include (1) summing up, (2) a statement of conclusions, (3) a statement of recommendations, and (4) a graceful termination. Any one of these, or any combination, may be appropriate for a particular paper. Some papers do not need a separate concluding section, particularly if the conclusions have already been stated in the introduction.

(1) Summing up is likely to be the major function of the final section of a purely informational paper. If you include a summary, make sure you include only references to material that appeared earlier in complete form.

(2) Conclusions are convictions based on evidence. If you state conclusions, make certain that they follow logically from data you presented in the paper, and that they agree with what you promised in the introduction.

(3) Recommendations are more likely to be found in, say, technical reports than in scientific papers. But if you do include recommendations make sure they flow logically from data and conclusions presented earlier, with all necessary supporting evidence. As with the conclusions, recommendations should not disagree with what you led the reader to expect in your introduction.

(4) Graceful termination is achieved when the final sentence introduces no new thought but satisfactorily rounds off all that has gone before. Be warned against duplicating large portions of the introduction in the conclusion. Verbatim repetition is boring, creates a false unity, and is no compliment to the reader's attentiveness.

7. Acknowledgments

In general, limit acknowledgments to those who helped directly in the research itself or during discussions on the subject of the research. Acknowledgments to typists or illustrators are discouraged, as are acknowledgments to anonymous referees. Financial support of all kinds (for the specific piece of work reported, to an author, or to the institution where the work was carried out) is best acknowledged here rather than as footnotes to the title or to an author's name.

8. Appendixes

Appendixes conclude the text of a paper. Few papers need them. Their best use is for supplementary material that

is necessary for completeness but which would detract from the orderly and logical presentation of the work if inserted into the body of the paper. A proof of a theorem is a good example of material of this type.

Appendixes may also be used for supplementary material that is valuable to the specialist but of limited interest to the general reader. If extensive, such material should be omitted from the published article and deposited in AIP's Physics Auxiliary Publication Service instead (see Appendix J).

9. Selecting a title

The time to decide on a title is after the manuscript has been completed. It must achieve a compromise between succinct brevity and overly complete description. Omit decorative locutions such as "Thoughts on ...," "Regarding ... ." Avoid nonstandard abbreviations and acronyms. If properly written a title is short enough to be intelligible at a glance but long enough to tell a physicist if the paper is of interest to him or her.

10. Authorship

It is common to include as "authors" all those who took part in the scientific endeavor described in the paper, even though only one wrote the manuscript. Make sure that each individual whose name appears in the byline is aware of this fact. It is not the responsibility of the journal editor, or of AIP, or the Member Society that owns the journal, to confirm that each author approves of the paper as submitted or even knows that his or her name is attached to it.

11. Final draft

When you have completed the first draft of your manuscript, lay it aside for several days. Then re-read it critically for final revisions. Ask two or three colleagues, at least one of whom is less familiar with the subject than you are, to read your manuscript critically for clarity, conciseness, completeness, logic, and readability. If one of these readers tells you that a passage is unclear, do not argue that it is, in fact, perfectly clear (to you!). Take the comment seriously and change the passage until it suits both of you.

B. WRITING THE ABSTRACT

The primary purpose of the abstract is to help prospective readers decide whether to read the rest of your paper. Bear in mind that it will appear, detached from the paper, in abstract journals and on-line information services. Therefore it must be complete and intelligible in itself; it should not be necessary to read the paper in order to understand the abstract.

The abstract should be a clear, concise summary of the principal facts and conclusions of the paper, organized to reflect its pattern of emphasis. Remember that some readers may use the abstract in lieu of the parent document. The title and abstract together will often be used as a basis for indexing; hence they must mention all the subjects, major and minor, treated in the paper. Understanding these considerations, you will want to give as much care to writing the abstract as you did to writing the paper. Some guidelines to assist in this task follow.

(1) State the subject of the paper immediately, indicating its scope and objectives. Do this in terms understandable to a nonspecialist. Describe the treatment given the subject by one or more such terms such as "brief," "comprehensive," "preliminary," "experimental," or "theoretical."

(2) Summarize the experimental or theoretical results, the conclusions, and other significant items in the paper. Do not hesitate to give numerical results or state your conclusions in the abstract.

(3) If the paper is one of a series, indicate that there are related papers.

(4) Indicate the methods used to obtain experimental results. If they are novel, state the basic principles involved, the operational ranges covered, and the degree of accuracy attained.

(5) Do not cite the literature references by the numbers in the list at the end of the paper, and do not refer by number to a selection, equation, table, or figure within the paper. Nonstandard symbols and abbreviations used in the abstract must be defined there as well as in the main text.

(6) Use running text only. Never use displayed mathematical expressions or numbered equations. Omit tables, figures, and footnotes.

(7) Keep the length of the abstract to a small percentage of that of the paper, usually 5% for papers of medium length, less for longer papers, and never exceeding 500 words. Write concise, straightforward English; make every word count. Try to substitute words for phrases and phrases for clauses. Be terse, but not telegraphic; do not omit a's, an's, or the's. Regardless of the length of the final draft of your abstract, study it again with a view to shortening it further to a minimum length.

(8) As with the paper itself, have the abstract read critically by some of your colleagues for clarity, completeness, proper emphasis, and objectivity.

C. PREPARING THE MANUSCRIPT

Rules for the physical presentation of the manuscript are designed to ease the work of editors, copyeditors, and typesetters. If presented in the preferred format, papers are more likely to proceed smoothly through the editor's selection process and the publisher's copyediting and composition routines. As well as the general instructions given here, some journals have special requirements that are explained in the "Information for Contributors" page or pages published therein.

1. General instructions

(1) Submit manuscripts in English only (American spelling). If you are not fluent in English, ask a colleague who is to read and correct your manuscript.

(2) Type or print the manuscript on good quality white paper, preferably 215×280 mm (8½×11 in.) in size. European size A4 (210×290 mm) is also acceptable.

(3) Use a fresh black ribbon or cartridge in the typewriter or printer.

(4) If you use a word processor, do not use a dot-matrix printer in a mode that leaves a visible space between dots (usually called "draft mode").

(5) Type or print on one side of the page only.

(6) Leave wide margins on the left and right sides and at the top and bottom of the page.

(7) Double space the entire manuscript, including the abstract, footnotes and references, tables and figure captions.

(8) Indent paragraphs, so that the start of a new paragraph is clearly distinguished from the continuation of an existing one after a displayed equation.

(9) Number all pages in sequence, beginning with the title and abstract page.

(10) Submit the original manuscript and one or more duplicate copies, as required by the journal editor. A photocopy may be acceptable if it is exceptionally clean and legible. A manuscript too difficult for copyeditors and typesetters to process will be returned.

(11) Submit original line drawings or, preferably, high-quality glossy prints. Include a complete set of duplicates of all drawings with each duplicate copy of the manuscript (clear photocopies are satisfactory). Photocopies of continuous-tone photographs are acceptable only if they show all essential content.

2. Title

(1) Place the title about a third of the way down from the top of the first page.

(2) Begin the first word with a capital letter; thereafter capitalize only proper names and acronyms. See Fig. 1 for examples.

3. Authors' names and affiliations

(1) To simplify later indexing, adopt one form of name to use on title pages of all your manuscripts. For example, if you refer to yourself on one paper as John J. Doe, do not use J. J. Doe or John Doe on subsequent manuscripts.

(2) If your name does not follow the pattern, common in Europe, America, and elsewhere, of a given name or names followed by your family name, please indicate how your name should be alphabetized in indexes.

(3) Type or print the authors' names above their institution as shown in Fig. 1.

(4) Omit titles such as Professor, Doctor, Colonel, and so on.

(5) In the affiliation, use no abbreviations except D.C. (for District of Columbia). Give an adequate postal address, including the ZIP or other postal code and the name of the country if not U.S.A.

(6) For multiple authors and affiliations follow the examples in Fig. 1.

4. Receipt date

On the next line after the title type

(Received

as shown in Fig. 1. The editor will enter in the blank space the date on which the manuscript was received. If appropriate, the editor may later add a phrase such as "revised manuscript received ..." or "accepted ... ."

5. Abstract

(1) Begin the abstract on a new line below the receipt date.

(2) Use wider side margins for the abstract than for the rest of the manuscript, so that it will be clear where the abstract ends and the main text begins.

(3) Type or print the abstract double spaced, preferably as one paragraph of continuous text. Avoid displayed mathematical expressions, figures, and tables.

(4) If a reference to the literature is needed, write it out within square brackets in the text of the abstract rather than referring to the list at the end of the paper. For example:

> The measurement of hydrogen permeation into iron reported by W. R. Wampler [J. Appl. Phys. **65**, 4040 (1989)], who used a new method based on ion beam analysis,...

(5) Define all nonstandard symbols, abbreviations, and acronyms.

6. Indexing

After the abstract write the Physics and Astronomy Classification Scheme codes on a new line, thus:

PACS numbers: 44.30. + v, 62.20.Pn, 68.30. + z

See Appendix I for information on the PACS indexing codes, which are used in a variety of abstracting and indexing services and bibliographic databases.

7. Section headings

(1) For most journals four levels of section headings are available, as shown in Table I. We suggest that you write principal headings in all capital letters, and lower-level headings with an initial capital letter to the first word only, as shown in Table I.

(2) If headings are numbered or lettered, use the scheme indicated in Table I: roman numbers, capital letters, arabic numerals, and lower-case letters in that sequence for the four levels of heading. Number or letter consecutively through the text.

(3) Headings are not required, and may be inappropriate for short papers. Many journals have "Letters" or "Notes" sections in which headings are expressly forbidden.

8. Acknowledgments

(1) The acknowledgments section follows the main text of the paper and precedes any appendixes and the list of references.

(2) In most journals it is recommended that this section be given a principal heading ("ACKNOWLEDGMENTS"), but if there is only one acknowledgment the singular form may be used.

(3) Acknowledgments of financial support are best given last, as a separate paragraph. The following are typical forms for such acknowledgments:

Drag on an axially symmetric body in the Stokes flow of micropolar fluids

John J. Doe and James G. Smith

Department of Physics, Massachusetts Institute of Technology, Cambridge, Masssachusetts 02139

(Received

Photoemission spectra of d-band metals.

II. Experiments on Rh, Ir, Ni, Pd, and Pt

Ellen Jones,[a] John J. Doe,[b] and B. H. N. Baker[a]

[a] Department of Chemistry, The Johns Hopkins University, Baltimore, Maryland 21218
[b] Battelle Memorial Institute, Pacific Northwest Laboratory, Richland, Washington 99352

(Received

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pp interactions at 300 GeV/c: Measurement of the charged-particle multiplicity and the total and elastic cross sections

J. I. Herman

Department of Physics and Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720, and Blackett Laboratory of Physics, Imperial College, London SW7 2BZ, England

Alfred E. Schmidt and Kurt Schwarz

Fakultät für Physik, Universität Bielefeld, 48 Bielefeld, Federal Republic of Germany

(Received

FIG. 1. Examples of title pages for manuscripts submitted to AIP journals.

TABLE I. The four levels of section headings in the body of a manuscript.

As typed in manuscript	As printed in most journals
I. PRINCIPAL HEADING	**I. PRINCIPAL HEADING**
A. First subheading	**A. First subheading**
1. Second subheading	***1. Second subheading***
a. Third subheading. Followed immediately, on the same line, by text.	*a. Third subheading.* Followed immediately, on the same line, by text.

This work was supported in part by National Science Foundation Grant No. I 48374X.

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Acknowledgment is made to the Donors of the Petroleum Research Fund, administered by the American Chemical Society, for partial support of this research.

9. Appendixes

(1) Appendixes follow the acknowledgments and precede the list of references.

(2) Headings to appendixes have the form of principal headings. If there are two or more appendixes, they can be labeled A, B, C, etc. Examples:

APPENDIX
APPENDIX: CALCULATION OF F(t)
APPENDIX A
APPENDIX C: PROOF OF THE EQUIVALENCE THEOREM

10. Footnotes and references

The format outlined below assumes that references will be cited in the style adopted by most journals of AIP and its Member Societies; that is, citations indicated by superscript numerals in consecutive numerical order through the text, with the references themselves arranged in the same order at the end of the paper. An alternative arrangement, where citations in text are by author's last name and year with the references arranged in alphabetic order, may be permitted in some cases. It is advisable to check with the journal editor before adopting the latter plan.

(1) Type or print all footnotes and references in order of citation as a separate, double-spaced list at the end of the manuscript, after the acknowledgments and appendixes and before tables and figures. Do not type footnotes on the manuscript pages on which they are cited.

(2) Type or print each footnote as a separate indented paragraph beginning with the appropriate superscript indicator.

(3) For footnotes to the title, authors' names, and authors' affiliations, the sequence of symbols [a], [b], [c], etc. is used in some journals, while others use the sequence of symbols *, †, etc. Check a recent issue of the journal to which the paper is submitted for the correct form. Do not use these symbols to indicate citations in the body of the paper. Acknowledgments of financial support should be made in the acknowledgment section, not as footnotes to the title or an author's name.

(4) For references cited in the text use superscript numerals running consecutively through the text: [1], [2], [3], etc. Place citation indicators after commas, periods, quotation marks, colons, and semicolons:

As pointed out by Bray,[6] these calculations are in agreement with other experimental values.[7,8]

We obtained the following values for the two parameters:[13–15] $I = 0.775$ and $\hat{r}_0 = 0.590$.

Do not put citation indicators where they might be mistaken for numbers with a different meaning. Write:

A recent measurement[2] of $\Delta\nu$...

instead of

A recent measurement of $\Delta\nu^2$...

(5) In text, refer to authors by last name (surname, family name) only. In the references themselves, give authors' names in the form in which they appear on the title page of the cited work. For names in the west European tradition, retain the order that puts the family name last (for example, John J. Doe, not Doe, John J.).

(6) For the recommended form and content of bibliographic references see Table II. In journal references use the standard abbreviation for journal names given in Appendix G. Give the volume number, the first page number, and the year of publication.

Some AIP and Member Society editors may permit inclusive page numbers (first and last) and some may allow or require article titles in the references. Check with the individual journal if you want to add these features.

Include the issue when the journal is not paginated consecutively through the volume (for example, *Physics Today*, *Scientific American*). Give the year in place of the volume number only when the journal does not use volume numbers. References to errata should be labeled as such, as should references to "abstract only" or "title only" publications.

In book references always include the title, the authors' or editors' names, the publisher's name and location, and the year of publication. References to laboratory reports should not contain abbreviations or acronyms for the names of laboratories or agencies; spell them out.

The use of the expression "*et al.*" (as in "Jones *et al.*[8] studied this reaction in 1982") is encouraged in the body of the paper, but discouraged in the references unless there are

TABLE II. Examples of footnotes.

Kind of footnote	As typed in manuscript
Footnote to author's name	[a] Permanent address: Nevis Laboratories, Columbia University, Irvington, NY 11027
Journal article citations	[1]Gale Young and R. E. Funderlic, J. Appl. Phys. 44, 5151 (1973).
Same author, two different journals	[2]T. L. Gilbert, Phys. Rev. B 12, 2111 (1975); J. Chem. Phys. 60, 3835 (1974).
Same authors, two references to same journal (one an erratum); different author, same journal	[3]T. Nenner, H. Tien, and J. B. Fenn, J. Chem. Phys. 63, 5439 (1975); 64, 3902(E) (1976); Harold F. Winters, ibid. 64, 3495 (1976).
Article title included	[4]R. Plomp, "Rate of decay of auditory sensation," J. Acoust. Soc. Am. 36, 277–282 (1964).
Issue number included	[5]Marc D. Levenson, Phys. Today 30 (5), 44–49 (1977).
Year in place of volume number	[6]H. W. Taylor, J. Chem. Soc. 1966, 411.
Translation-journal article	[7]V. I. Kozub, Fiz. Tekh. Poluprovodn. 9, 2284 (1975) [Sov. Phys. Semicond. 9, 1479 (1976)].
Book reference	[8]L. S. Birks, Electron Probe Microanalysis, 2nd ed. (Wiley, New York, 1971), p. 40.
	[9]D. K. Edwards, in Proceedings of the 1972 Heat Transfer and Fluid Mechanics Institute, edited by Raymond B. Landis and Gary J. Hordemann (Stanford Unversity, Stanford, CA, 1972), pp. 71–72.
Different authors, same book	[10]Robert G. Fuller, in Point Defects in Solids, edited by James H. Crawford, Jr. and Lawrence M. Slifkin (Plenum, New York, 1972), Vol. 1, Chap. 2, pp. 103–150; M. N. Kabler, ibid., Vol. 1, Chap. 6, pp. 327–380.
References to unpublished work	[11]J. Moskowitz, presented at the Midwest Conference on Theoretical Physics, Indiana University, Bloomington, IN, 1966 (unpublished).
	[12]R. C. Mikkelson (private communication).
	[13]R. T. Swan and C. M. Pitman, Saclay Report No. CEA-R 3147, 1957 (unpublished).
	[14]James B. Danda, Ph. D. thesis, Harvard University, 1965.
Reference to patent	[15]W. J. Thompson and D. R. Albert, U. S. Patent No. 7,430,020 (3 March 1975).
Reference to film	[16]Technology: Catastrophe or Commitment?, film produced by Hobel-Leiterman Productions, Toronto (distributed by Document Associates, Inc., 880 Third Ave., New York, NY 10022; released 1974), 16 mm, color, 24 min.
Reference to computer program	[17]Norman R. Briggs, computer code CRUX (Bell Laboratories, Murray Hill, NJ, 1972).

more than three authors' names.

"In press" or "to be published" means that the paper has been accepted for publication in a journal, and the title of the journal must be given. Such a reference may be updated at the proof stage if the referenced paper has been published by then.

(7) Refer to the original sources whenever possible as you gather details for bibliographic references. Do not rely on intermediate citations, which may contain misspelled names or erroneous volume and page numbers and publication dates.

(8) Avoid references to unpublished material that is difficult or impossible to obtain. If you must refer to unpublished material of your own, consider preparing it for deposit in AIP's Physics Auxiliary Publication Service (see Appendix J).

(9) For footnotes to tables, see point (8) of the next section.

11. Tables

(1) Tabular material more than four or five lines long should be presented as a numbered table with a caption, not included as part of the running text.

(2) Type or print each table double spaced on a separate page after the references and before the figure captions. Place the table caption directly above the table to which it belongs, not on a separate sheet. See Table III for an example.

(3) Number the tables in the order of appearance in the text, and make sure each table is cited in text. Tables displayed and cited in proper sequence in the main body of the paper may be mentioned out of sequence in the introduction.

(4) Give every table a caption that is complete and intelligible in itself without reference to the text.

(5) Give every column a heading. Make it clear and concise. Capitalize the first word of a heading unless it is a standard abbreviation that is always used lower-case.

Units of measurement should be placed in parentheses on the line below the appropriate heading. Choose units so that entries are near unity in magnitude, so that, as far as possible, powers of ten are not needed for most entries.

(6) Align columns of related numbers by decimal. Do not use "ditto" or any symbol such as quotation marks to indicate repeated entries; write each entry out in full. Use raised dots (···) instead of dashes to indicate missing values.

(7) Type or print a double horizontal line below the table caption, a single line below column headings, and another double line at the end of the table. Avoid vertical lines between columns: use appropriate spacing instead.

(8) Footnotes to a table are indicated by a sequence of lower-case letters [a], [b], [c], etc., with a new sequence starting with [a] for each table. The ordering of footnote indicators should be left to right across one row, then left to right across the next row, and so on. Place the footnotes themselves below the double line at the end of the table.

TABLE III. Caption of a fictitious table illustrating the types of problems that may arise in preparing tables as part of a manuscript.

Author	Renormalized atom ρ_{1s}	Renormalized atom ρ_{2s}	T (s)	Cross section (10^{-6} cm^2)	Assignment
Clement[a]	11.2888	2.420 300	55 019	1.383 ± 0.002	ν_1, CH_2 wag
Roth et al.[b]	9.5992	2.420 300	43 300	1.389 ± 0.006	ν_{18}, SiH stretch
Manchester[c]	10	...[d]	9 502	...[d]	Lattice vibration
Stark and Auluch[e]	9.0933	2.942 2	47 226	0.98 ± 0.03	a = 32, c = 4.9
This work	10.04	2.788 84	21 736	0.87 ± 0.01	$\nu_9 - \nu_{17} = 241$, CH_3 symmetric deformation

[a] Michael J. Clement, J. Phys. Solids 28, 16–21 (1967).
[b] Reference 9.
[c] References 11 and 13.
[d] See Table II and Ref. 4.
[e] Reference 15.

(9) In designing a large table, take into account the size of the journal page on which it is to be printed. Tables may be continued onto a second page or beyond, in which case the column headings will be repeated. Tables may also be turned 90° from the usual orientation.

(10) Large and complex tables are sometimes submitted in "camera-ready" form, which means that they can be reproduced directly from the author's manuscript without re-composition. This process eliminates one stage where keying errors can be introduced, and reduces the amount of proofreading needed, at the possible cost of reduced typographic standardization. Consult the editor about this option.

(11) Extensive tabular material of relatively limited interest may be deposited in AIP's Physics Auxiliary Publication Service (see Appendix J).

12. Figures and figure captions

(1) Type or print the list of figure captions double spaced on a separate page or pages at the end of the manuscript. Place the figures themselves in sequence after the collected captions.

(2) Number figures in order of their appearance in the text and make sure that every figure is cited. Figures displayed and cited in proper sequence in the main body of the paper may be mentioned out of sequence in the introduction.

(3) Every figure must have a caption that is complete and intelligible in itself without reference to the text. Type each caption as one paragraph, beginning with the figure number in the form:

FIG. 1. Variation of distance R with...

(4) Figures can be reproduced in color when necessary, and where the color adds scientific information not clearly available in an equivalent monochrome version. There may be additional costs to be borne by the author for color reproduction. Consult the editor in each case.

(5) For detailed instructions on the preparation of figures, see Sec. V.

– SEE ADDENDUM –

D. SUBMISSION OF TEXT IN DIGITIZED FORM

Word processors have now become very familiar writing tools, and they are used in the preparation of most of the manuscripts submitted for publication. Authors frequently ask if the digitized versions of their texts can be used by the publisher to eliminate one extra keyboarding step. These digitized texts are offered on diskettes, on magnetic tape, or as on-line transmissions over the telephone lines.

The journals of AIP and its Member Societies are composed in a number of different locations on different typesetting systems. For example: the journals of the American Physical Society are typeset on APS's in-house system; the journals of AIP and those Member Society journals that are published by AIP are typeset on AIP's in-house system. Some journals of the Optical Society of America, the American Astronomical Society, and the American Geophysical Union are typeset by commercial composition houses. Currently the lack of standardization makes it impossible to generalize about the requirements for all journals. In addition, the technology is changing so rapidly that specific information about individual journals is likely to become out of date very quickly.

As this edition of the *AIP Style Manual* goes to press, APS is accepting digitized manuscripts written in a specific version of TEX, REVTEX, and in TROFF, a UNIX-system typesetting language. AIP, which is in transition between two composition systems, is preparing to accept certain TEX manuscripts on diskette by 1990. Meanwhile AIP has had considerable success capturing the purely textual parts of well-typed manuscripts in digitized form by optical scanning. An "intelligent" optical character reader enables the data to be captured from a clean manuscript typed in any reasonable format without special preparation by the author.

Progress continues to be made toward easy preparation of scientific texts in standardized form by authors, and toward the efficient interpretation of word-processor output files by large-scale composition systems. Closure will certainly occur soon, and the complex situation described in the preceding paragraphs will then be out of date. Meanwhile, any author wishing to submit a digitized manuscript should discuss his or her plans with the editor of the appropriate journal as early in the process as possible.

For the foreseeable future it is likely that editors will continue to require a printed version ("hard copy") accompanying any electronic submission, for use during the review process.

E. PROOFREADING THE PAPER

1. Manuscript

(1) As a final step before submitting the manuscript, proofread it. There are always errors, however excellent the typist. Ask someone else to proofread it too: a fresh pair of eyes can find errors you have overlooked.

(2) Avoid handwritten corrections and changes. Retype instead, and proofread all retyped material.

(3) As you proofread, check the following points:

(a) If the section headings are numbered or lettered, are they numbered or lettered consecutively according to the scheme in Table I? Are the cross-references to sections correct?

(b) Are all ambiguous mathematical symbols identified?

(c) Are all numbered equations in proper sequence and cited correctly in text?

(d) Are all footnotes and references cited in the paper? Do all the citation indicators in text refer to the correct footnote or reference?

(e) Are all tables and figures cited in order in the text?

2. Galley or page proofs

Proofs are sent to authors so they can verify the accuracy of typesetting. You are responsible for any errors that remain after you have proofread your paper.

(1) Check and return proofs promptly, within 24 hours if possible. Delay in returning proofs can lead to delay in the publication of the article. Return corrected proofs to the office indicated on the cover sheet sent with them, not to the editor.

(2) Check any questions that may be transmitted to you from editor or publisher with the proofs. Answers should be written on the proof copy, not on the manuscript. Sign the cover sheet to show that you have read the proofs, and return it with the proofs and the original manuscript.

(3) Keep changes to a minimum. Proofs are sent to authors to enable them to find errors in typesetting, not to give them a last-minute chance to rewrite the paper. Changes from the original are costly and may delay publication, particularly if they are extensive enough to require a new review by the editor. Authors may be charged for excessive alterations on the proofs.

(4) Use the proofreaders' symbols given in Appendix H. In galley proofs, use the left margin for correcting errors in the left half of the galley and the right margin for correcting errors in the right half. In two-column page proofs, use the left margin for correcting errors in the left column, and the right margin for correcting errors in the right column: do not use the space between the columns.

(5) The subheading "Note added in proof" may be used to introduce a discussion of information obtained after completion of the manuscript, but in this case the paper will be resubmitted to the editor for review of the additions.

(6) Check that there are proofs of all figures. Proofs will probably be photocopies of the reduced original figures, which do not show the quality of the final printed version, and they may or may not be shown in place on a page proof.

(7) Check that figures and captions are correctly associated. If each figure is not already in place on a page proof there will be a notation defining how it is to be placed, and the figure caption should be in the correct position.

(8) Make a photocopy of the corrected proofs and keep it for reference in case of later questions.

III. General style

A. GRAMMAR AND PUNCTUATION

Scientific writing is not exempt from the rules of good grammar, usage, and punctuation, although scientific conventions may modify some rules. Standard, authoritative references like Strunk and White's *The Elements of Style*[1] and *The Chicago Manual of Style*[2] can be invaluable, even to scientific writers with much experience.

Good punctuation is an aid to clarity. Wrongly placed punctuation may introduce ambiguity into a sentence, or even change the sense. Excessive punctuation is as undesirable as too little punctuation. A good working rule is that, if someone familiar with the subject has to reread a sentence in order to understand it, the sentence probably needs more punctuation—or rewriting. Keep in mind that the journals of the Institute and its Member Societies are read by many for whom English is not a native language. It should be impossible to misunderstand a properly written, properly punctuated, sentence.

The following rules for grammar and punctuation have special application to scientific writing.

1. Commas

(1) A comma goes before "and" or "or" in a series of three or more:

Sn, K, Na, and Li lines are invisible.

(2) Write dates as follows, without commas:

23 March 1989

(3) Separate superscript reference numbers by commas (but use a dash to indicate a range of numbers):

Recent studies of carrier-transport phenomena[6,7,9–11] have revealed...

(4) Do not represent decimal points by commas:

1.0 (not 1,0)

Place decimal points on the line:

1.0 (not 1·0)

(5) Numbers with four or fewer digits on either side of the decimal point are closed up and unpunctuated:

1200 4620.010 24.0032 cm

Numbers with five or more digits on either side of the decimal point are written with spaces instead of commas:

12 000 6 427 020 24.077 094 3 cm

Conflict with the European convention of using commas instead of decimal points is thereby avoided.

2. Numbers

(1) In general, use words for numbers up to ten:

one equation third two-dimensional tenfold

Use numerals for numbers above ten:

11 equations 13th 11-fold

There are exceptions:

(a) For consistency, use numerals for all the numbers in lists containing numbers above *and* below ten:

"Groups of 8, 52, and 256 particles...."

(b) Numbers used as nouns are almost always numerals:

sample 2, counter 4, ratio of 3:5, values of 0 and 1 (or values of zero and unity).

(c) The dimensions of matrices should be given in numerals:

2×2 matrix

(d) The number before a unit of measure is always written in numerals:

6 V

(2) Decimal points should never be left "naked":

.03 (correct style is 0.03)

106. (correct style is 106 or 106.0, whichever is meant)

3. Quotation marks

(1) Place quotation marks after commas and periods, before colons and semicolons:

... the "whistlers,"... the "whistlers":

Use double quotation marks, as shown. Single quotation marks should be used only within material already enclosed in double quotation marks.

(2) New or special usage calls for quotation marks around the word or phrase in question—but only at its first appearance:

> The resonance is an extra tunneling channel, or "window," in the barrier. Tunneling electrons with total energy $E + E_r$ will always be able to see the window, but do not necessarily exit through it.

(3) Do not use quotation marks around standard nomenclature. Write

The nearest-neighbor distance taken from...

instead of

The "nearest-neighbor" distance...

(4) Do not use quotation marks to set off symbols from straight text. Write

Constants a and b are given by...

instead of

Constants "a" and "b"...

1. William Strunk, Jr. and E. B. White, *The Elements of Style*, 3rd ed. (Macmillan, New York, 1979).
2. *The Chicago Manual of Style*, 13th ed. (University of Chicago, Chicago, 1982).

4. Possessives

The following forms are correct:

When Smith and Green's theory[26] is applied...

When the Smith–Green[26] theory is applied...

5. Plurals

(1) To form the plural of numbers, add s:

Since the late 1950s much work has...

(2) For symbols add 's:

x's, K_x's.

The singular form may serve as a plural, however:

Values for various M_r...

and

Values for various M_r's...

are both permissible.

(3) For abbreviations add 's:

LCAO's.

6. Parentheses

(1) A sentence in parentheses inserted into another sentence does not end with a period inside the closing parenthesis:

This is clearly not the case (see Fig. 2), so that our initial conjecture would appear to be correct (compare, however, with results of Jones at nonzero temperatures).

An isolated sentence or two in parentheses has a period *inside* the closing parenthesis, and begins with a capital letter:

Equation (58) represents the effect of the magnetic anisotropy. (Note that T_c was defined for zero field and zero magnetic anisotropy. A generalized definition for nonzero field is implied.)

(2) Use square brackets for a parenthetical remark that already contains parentheses:

Recall that the susceptibility [see Eq. (A4)] receives a Curie term.

(3) Pairs of parentheses should surround the letters or numbers used to label the elements of enumerative lists:

The three remaining cases are (a) isotopic, (b) nearly elastic, and (c)polar optical scattering.

(4) Always use parentheses in citations of equations and parts of figures:

In Eq. (13) In Fig. 4(a)

Keep the parentheses intact in multiple citations:

In Eqs. (13), (14), and (16)
[not (13, 14, 16)]

In Eqs. (3a)–(3c)
[not (3a–c)]

In Figs. 4(a) and 4(b)

[not 4(a,b)]

In Figs. 2(a)–2(c)
[not 2(a–c)]

(5) Do not use parentheses in reference citations:

Scott *et al.*[2]
[not Scott *et al.*(2)]

In Ref. 5
[not Ref. (5)]

7. Spelling and hyphenation

Spelling and hyphenation in scientific writing are often controversial points of style. For nonscientific words *Webster's Third New International Dictionary*[3] is still the principal authority (*Webster's Ninth New Collegiate Dictionary* is a convenient abridgment). If a word has alternative spellings (for example, analog or analogue), choose the preferred form (analog) given in Appendix B. Recommended spellings for scientific words not found in standard dictionaries (for example, bandwidth) and correct spellings of words frequently misspelled (for example, parametrize) are also listed in Appendix B.

Some general guidelines for spelling follow.

(1) The tendency in scientific spelling is to avoid the hyphen when it does not serve a useful purpose. Words that formerly were hyphenated have now in considerable numbers become either one word or two. Thus, compound nouns such as

buildup	cutoff	output
crossover	knockout	setup

are usually spelled as one word, and nouns such as

t channel	α particle	p type
δ function	x ray	s wave

are spelled as two words. For exceptions, see Appendix B.

(2) Words with prefixes and suffixes are usually "closed up" (spelled without hyphens):

multivalent nonradioactive stepwise

There are important exceptions, however:

(a) If closing up would produce a double letter, hyphenate instead: non-negative, semi-infinite. For particular exceptions to this exception (for example, unnecessary, coordinate) see Appendix B.

(b) If the prefix or suffix is added to a proper noun, symbol, or numeral, hyphenate: non-Fermi, pseudo-P, di-MeB, 12-fold.

(c) Italic-letter chemical prefixes and suffixes are hyphenated: *cis*-dimethylethylene, dimethylnitrosamine-d_6. Number prefixes are also hyphenated: 1,2-dimethylbutylene.

3. *Webster's Third New International Dictionary*, unabridged, 3rd ed. (G. & C. Merriam, Springfield, MA, 1986), and *Webster's Ninth New Collegiate Dictionary* (G. & C. Merriam, Springfield, MA, 1985).

(d) If the prefix or suffix is added to two or more words, hyphenate them all: non-time-independent, quasi-free-electron, free-electron-like.

(e) If closing up would change the meaning, hyphenate: un-ionized, re-solved.

(3) "Self" words, "free" words, and "half" words are usually hyphenated:

self-consistent	half-width
divergence-free	half-life

(4) Modifiers made up of two or more words are usually hyphenated:

Bridgman-grown sample	x-ray analysis
thin-film results	6-keV data

When such hyphens forestall ambiguity, they are essential:

In contrast to the many-gauss dipolar lines...
Given the wrong-signature points...

But omit the hyphen (i) when the first word of the modifier is an adverb ending in -ly (rapidly increasing attenuation), or (ii) when the modifier is a predicate adjective ("The samples were Bridgman grown...").

(5) Do not use British spellings. Write, for example,

analyze (not analyse)	liter (not litre)
center (not centre)	meter (not metre)
color (not colour)	program (not programme)

Proper names are an exception: International Centre for Theoretical Physics.

8. Mathematical English

(1) Punctuate all equations, in running text and in display, according to their function in the sentence. Compare

(a) If $x = 1$, the Regge-pole model is...

with

(b) If $x = 1$ is taken to be a limiting condition...

In case (a) the equals sign of the equation acts as the verb of a subordinate clause ("If x equals 1, the..."). In case (b) the same equation acts as a noun.

(2) If a subordinate clause ends with a symbol or number, the ensuing main clause should begin with a word:

If $a = b$, then c holds too.

is more readable than

If $a = b$, c holds too.

(3) Avoid starting a sentence with a symbol or number, especially when the preceding sentence ends with a symbol or number. For example, change

$\rho b(\omega)$ is the density of states in branch b. c_b, the coupling constant of Eq. (1), can be shown to be proportional to q_2, and...

to

Here $\rho b(\omega)$ is the density of states in branch b. The coupling constant c_b of Eq. (1) can be shown...

(4) Do not place commas or parentheses around a symbol or expression if it immediately follows the noun that defines it:

The relaxation time T_i can...

The local approximation $\epsilon' = 2t + \omega_p u^2$ gave values for...

But add commas or parentheses if another phrase intervenes:

The relaxation time with no magnetic field, T_0, and with a magnetic field, T_h, can...

The local approximation determined by Watt ($\epsilon' = 2t + \omega_p u^2$) gave ...

(5) Nonrestrictive clauses are introduced by "which" and set off by commas:

The $K = 0$ component, which does not influence the band shape, gives rise to...

Without commas, this sentence could be misread to mean that there is more than one $K = 0$ component, one of which does not influence the band shape.

Restrictive clauses are usually introduced by "that" and are not set off by commas:

The data that we have accumulated can be used for a determination of...

(6) Dangling participles are always awkward and sometimes misleading. A clumsy sentence such as

Substituting Eq. (5) in Eq. (6), the thermal conductivity becomes $\frac{1}{3}kNVL$.

is easily improved:

Substituting Eq. (5) in Eq. (6), we obtain $\frac{1}{3}kNVL$ for the thermal conductivity.

or:

Substituting Eq. (5) in Eq. (6) gives $\frac{1}{3}kNVL$ for the thermal conductivity.

9. "I," "we," and impersonal constructions

(1) The old taboo against using the first person in formal prose has long been deplored by the best authorities and ignored by some of the best writers. "We" may be used naturally by two or more authors in referring to themselves; "we" may also be used to refer to a single author and the author's associates. A single author should also use "we" in the common construction that politely includes the reader: "We have already seen... ." But never use "we" as a mere substitute for "I," as in, for example, "In our opinion...," which attempts modesty and achieves the reverse; either write "my" or resort to a genuinely impersonal construction.

(2) The passive is often the most natural way to give prominence to the essential facts:

Air was admitted to the chamber.

(Who cares who turned the valve?) But avoid the passive if it makes the syntax inelegant or obscure. A long sentence with the structure

The values of ... have been calculated.

is clumsy and anticlimactic; begin instead with

I [We] have calculated...

(3) "The author(s)" may be used as a substitute for "I [we]," but use another construction if you have mentioned any other authors very recently, or write "the present author(s)."

(4) Special standards for usage apply in two sections of a paper: (i) Since the abstract may appear in abstract journals in the company of abstracts by many different authors, avoid the use of "I" or "we" in the abstract; use "the author(s)" or passives instead, if that can be done without sacrificing clarity and brevity. (ii) Even those who prefer impersonal language in the main text may well switch to "I" or "we" in the acknowledgments, which are, by nature, personal.

10. Capitalization

(1) The preferred style is to capitalize adjectives and nouns formed from proper names:

Gaussian Hamiltonian Ohmic

But there are four kinds of name-derived nouns that are always lower case:

(i) units of measure (gauss, amperes),
(ii) particles (fermion, boson),
(iii) elements (einsteinium), and
(iv) minerals (scheelite, fosterite).

(2) Lower-case symbols and abbreviations are never capitalized in titles or headings or at the beginning of a sentence. It is better, however, to begin a sentence with a word. Change

ac Stark effects in the multiphoton ionization of atomic sodium were studied by Keynes *et al.* for...

to

Keynes *et al.* studied ac Stark effects...

(3) Single words or phrases introduced by a colon never begin with a capital letter:

We obtained values for two parameters: the quantum cyclotron radius and the Debye shielding radius.

If a colon introduces a complete sentence, the first word may be—but need not be—capitalized:

We are led to the following conclusion: The fast electron mode represents an unloading of excess excitons formed during excitation.

or

We are led to the following conclusion: the fast electron mode...

But if a colon introduces more than one sentence, always capitalize the first word:

Our experience with diamond suggests several conclusions bearing on future XPS studies: First, surface contamination can contribute substantially to the observed spectra. Second, available calculations of the density of states within a valence band are not directly useful for qualitative results. Third,...

(4) Do not capitalize

column 4	curve B	sample 1
counter 12	model 4A	type 4A

On the other hand, the prominence gained by capitalization befits

Appendix A	Lemma 2	Table 1
Corollary 1	Paper H	Theorem 1

Capitalize only the name in

Avogadro's number	Debye temperature
Bohr radius	Ohm's law

Note the following particular cases:

Fermi's "golden rule"
general theory of relativity
second law of thermodynamics

(5) The words Addendum, Comment, Communication, Letter, and Note are capitalized only when they denote a specific section of a journal, as opposed to, say, someone's informal remark or private letter; the words article, paper, and report are never capitalized.

(6) Protected trade names must be capitalized: Nichrome, Plexiglas.

(7) Small capitals are used for computer programs (ABACUS, QUAD) and for ionization states in atomic spectroscopy (Fe III). Note the difference between Fe III and Fe(III) and between He I and He I.

Indicate small capitals with a double underline in black pencil.

11. Abbreviations

(1) The abbreviation for a single word is usually a clipped form of the word, lower case, and unpunctuated:

av for average const for constant

The abbreviation for a phrase is usually an acronym, capitalized, and unpunctuated:

MO for molecular orbital
BCS for Bardeen–Cooper–Schrieffer

See Appendix D for particular exceptions.

(2) Abbreviations invented by the author or not widely known outside the author's specialty (see Appendix D) should be defined the first time they occur in manuscript, and should be used sparingly:

Two-photon resonant (TPR) third-harmonic generation has been reported in cesium, thallium, and stron-

tium. In this paper we examine the special problems associated with TPR third-harmonic generation in metal vapors.

[14]Robert S. Cantor and Peter M. McIlroy, J. Chem. Phys. **90**, 4423–4430(1989), referred to as CM.

In long papers, such abbreviations should be redefined occasionally. An abbreviation introduced (and defined) in the abstract or in a figure caption or table should be defined again when it first appears in the body of the paper. This practice protects readers interested only in the text of the paper and readers who scan only the abstract, figures, and tables.

(3) Do not use abbreviations as mathematical variables. Such abbreviations as RRR for residual resistivity ratio or KE for kinetic energy may be used in text; but if they enter into mathematical expressions, they are almost as awkward as full words, and should be replaced with conventional symbols such as r_R or E_k.

(4) Use the standard abbreviations Eq., Fig., Ref., and Sec. or their plural forms before numbers:

In Eq. (3)	In Refs. 6–8
In Figs. 4 and 5	In Sec. II

But use the whole word even before a number if the word begins a sentence:

Equation (3) thus represents...

(5) For standard journal title abbreviations, see Appendix G.

12. Symbols for nuclides

Journals of AIP and its Member Societies follow the recommendations of the Symbols, Units, and Nomenclature (S.U.N.) Commission of the International Union of Pure and Applied Physics on the symbols to be used for nuclides and their states. The mass number is shown as an anterior superscript:

^{14}N

A posterior superscript can indicate either a state of ionization:

Ca^{2+}

or an excited state:

$^{110}Ag^{m}$, $^{14}N^{*}$

A posterior subscript is used to indicate the number of atoms in a molecule:

$^{14}N_2$.

B. SYMBOLS AND UNITS

A *physical quantity* is the product of a *numerical value* (a pure number) and a unit. Symbols for physical quantities are printed in italics, while symbols for units are printed in roman type.

Organizations such as the International Organization for Standardization (ISO) and the International Union for Pure and Applied Physics (IUPAP) have drawn up lists of recommended symbols for commonly encountered physical quantities.[4,5] Authors are encouraged to consult these sources and to use recommended symbols in their papers unless there are special reasons to deviate.

In the interests of good communication, authors should employ units that are accepted for use in the International System of Units (*Système Internationale*, SI). The SI includes seven *base units*, several *derived units* with special names, and certain other acceptable units. Table IV shows the base units, the derived units, and other acceptable units and their symbols.

To ensure uniformity in the use of the SI unit symbols, ISO and other international bodies give certain recommendations.

The product of two or more units may be indicated in either of the following ways:

$N \cdot m$ *or* $N\ m$

A solidus (an oblique stroke, /), a horizontal line, or negative exponents may be used to express a derived unit formed from two others by division:

m/s, $\frac{m}{s}$, or $m \cdot s^{-1}$

The solidus must not be repeated on the same line unless ambiguity is avoided by parentheses. In complicated cases negative exponents or parentheses should be used:

m/s^2 *or* $m \cdot s^{-2}$ *but not* $m/s/s$

$m \cdot kg/s^3 \cdot A$

or

$m \cdot kg \cdot s^{-3} \cdot A^{-1}$

but not

$m \cdot kg/s^3/A$

Compound prefixes, that is, prefixes formed by the juxtaposition of two or more SI prefixes, are not to be used.

For example,

1 nm *but not* 1 mμm

A prefix should never be used alone.

For example,

$10^6/m^3$ *but not* M/m^3

Names and symbols should not be mixed in a unit expression.

For example,

mol/L *or* mole/liter

but not

mol/liter *or* mole/L

A complete list of units of measure with their symbols (or abbreviations) is given in Appendix C.

4. *Units of Measurement*, ISO Standards Handbook 2 (International Organization for Standardization, Geneva, Switzerland, 1982).
5. E. Richard Cohen and Pierre Giacomo, *Symbols, Units, Nomenclature and Fundamental Constants in Physics* [International Union of Pure and Applied Physics, Document IUPAP-25 (SUNAMCO 87-1), 1987].

TABLE IV. SI base units, derived units, and other acceptable units and their symbols.

SI base units.

Quantity	SI unit	
	Name	Symbol
length	meter	m
mass	kilogram	kg
time	second	s
electric current	ampere	A
thermodynamic temperature	kelvin	K
amount of substance	mole	mol
luminous intensity	candela	cd

SI derived units with special names.

Quantity	SI unit			
	Name	Symbol	Expression in terms of other units	Expression in terms of SI base units
frequency	hertz	Hz		s^{-1}
force	newton	N		$m \cdot kg \cdot s^{-2}$
pressure, stress	pascal	Pa	N/m^2	$m^{-1} \cdot kg \cdot s^{-2}$
energy, work, quantity of heat	joule	J	$N \cdot m$	$m^2 \cdot kg \cdot s^{-2}$
power, radiant flux	watt	W	J/s	$m^2 \cdot kg \cdot s^{-3}$
electric charge, quantity of electricity	coulomb	C		$s \cdot A$
electric potential, potential difference, electromotive force	volt	V	W/A	$m^2 \cdot kg \cdot s^{-3} \cdot A^{-1}$
capacitance	farad	F	C/V	$m^{-2} \cdot kg^{-1} \cdot s^4 \cdot A^2$
electric resistance	ohm	Ω	V/A	$m^2 \cdot kg \cdot s^{-3} \cdot A^{-2}$
electric conductance	siemens	S	A/V	$m^{-2} \cdot kg^{-1} \cdot s^3 \cdot A^2$
magnetic flux	weber	Wb	$V \cdot s$	$m^2 \cdot kg \cdot s^{-2} \cdot A^{-1}$
magnetic flux density	tesla	T	Wb/m^2	$kg \cdot s^{-2} \cdot A^{-1}$
inductance	henry	H	Wb/A	$m^2 \cdot kg \cdot s^{-2} \cdot A^{-2}$
Celsius temperature	degree Celsius	°C		K
luminous flux	lumen	lm		$cd \cdot sr$
illuminance	lux	lx	lm/m^2	$m^{-2} \cdot cd \cdot sr$

TABLE IV (*continued*).

SI derived units with special names admitted for reasons of safeguarding human health.

	SI unit			
Quantity	Name	Symbol	Expression in terms of other units	Expression in terms of SI base units
activity (of a radionuclide)	becquerel	Bq		s^{-1}
absorbed dose, specific energy imparted, kerma, absorbed dose index	gray	Gy	J/kg	$m^2 \cdot s^{-2}$
dose equivalent, dose equivalent index	sievert	Sv	J/kg	$m^2 \cdot s^{-2}$

SI supplementary units.

	SI unit	
Quantity	Name	Symbol
plane angle	radian	rad
solid angle	steradian	sr

Units in use with the International System.

Name	Symbol	Value in SI unit
minute	min	1 min = 60 s
hour	h	1 h = 60 min = 3 600 s
day	d	1 d = 24 h = 86 400 s
degree	°	$1° = (\pi/180)$ rad
minute	′	$1′ = (1/60)° = (\pi/10\,800)$ rad
second	″	$1″ = (1/60)′ = (\pi/648\,000)$ rad
liter	l, L	$1 L = 1 dm^3 = 10^{-3} m^3$
metric ton	t	$1 t = 10^3$ kg

TABLE IV (*continued*).

Units used with the International System whose values in SI units are obtained experimentally.

Name	Symbol	Definition
electronvolt	eV	(a)
unified atomic mass unit	u	(b)

(a) The electronvolt is the kinetic energy acquired by an electron in passing through a potential difference of 1 volt in vacuum; 1 eV = $1.602\,19 \times 10^{-19}$ J approximately.

(b) The unified atomic mass unit is equal to (1/12) of the mass of an atom of the nuclide ^{12}C; 1 u = $1.660\,57 \times 10^{-27}$ kg approximately.

Units sanctioned for use with the International System.

Name	Symbol	Value in SI unit
nautical mile		1 nautical mile = 1 852 m
knot	kn	1 nautical mile per hour = (1852/3600) m/s
angström	Å	1 Å = 0.1 nm = 10^{-10} m
are	a	1 a = 1 dam^2 = 10^2 m^2
hectare	ha	1 ha = 1 hm^2 = 10^4 m^2
barn	b	1 b = 100 fm^2 = 10^{-28} m^2
bar	bar	1 bar = 0.1 MPa = 10^5 Pa
gal	Gal	1 Gal = 1 cm/s^2 = 10^{-2} m/s^2
curie	Ci	1 Ci = 3.7×10^{10} Bq
roentgen	R	1 R = 2.58×10^{-4} C/kg
rad	rad	1 rad = 1 cGy = 10^{-2} Gy
rem	rem	1 rem = 1 cSv = 10^{-2} Sv

SI prefixes.

Factor	Prefix	Symbol	Factor	Prefix	Symbol
10^{18}	exa	E	10^{-1}	deci	d
10^{15}	peta	P	10^{-2}	centi	c
10^{12}	tera	T	10^{-3}	milli	m
10^{9}	giga	G	10^{-6}	micro	μ
10^{6}	mega	M	10^{-9}	nano	n
10^{3}	kilo	k	10^{-12}	pico	p
10^{2}	hecto	h	10^{-15}	femto	f
10^{1}	deka	da	10^{-18}	atto	a

IV. Mathematical expressions

Since correct typographical presentation is crucial to understanding equations, authors of mathematical papers should read this section of the manual with special care: its aim is to inform authors of the limits of typesetting resources and to indicate standard methods of presentation that will ensure correct and efficient typesetting.

A. AVAILABILITY OF CHARACTERS FOR TYPESETTING

(1) The latin and greek alphabets available for use in technical material are described in Appendix E. The latin alphabet is available in five type styles, or "fonts": roman (upright), italic (oblique or slanted to the right), script (cursive), german (Fraktur), and sans serif (unadorned). Examples of standard lightface type and boldface (heavy) type are given in Appendix E (see also Sec. IV B 3).

(2) Appendix F is a catalog of available special symbols, grouped and numbered according to type: diacritics (accents), parentheses and brackets, mathematical signs of relation, mathematical operators, phonetic symbols, figure symbols, etc. Any of these symbols may be used if necessary, but it must be emphasized that, with due respect for accepted practice, mathematical notation should be kept as simple as possible.

(3) Any diacritical sign in Appendix F can be placed over (or under, or through) any alphanumeric character, including subscripts and superscripts:

$\overline{B}$, $\underline{2}$, $\hat{\lambda}$, $\underline{T}^{\alpha}$

Two levels of diacritical signs are possible, as in

$\hat{\tilde{\alpha}}$, $\dot{\tilde{y}}$.

Three levels are to be avoided.

(4) Symbols not listed in Appendix F can sometimes be specially made, but the cost is high and delay in publication will result. Use an alternative symbolism if possible.

(5) A mathematical expression used repeatedly throughout a paper should be defined in terms of an appropriate symbol the first time it appears. Then the symbol can be used as shorthand for the expression. Look for opportunities to use this technique for shortening the paper and reducing the chance of errors in typesetting.

B. MARKING OF MATHEMATICAL MATERIAL

The importance of legible mathematical material cannot be overemphasized. Keep in mind that typesetters will reproduce what they see, not what you know. Since typed or printed material is far more legible than hand writing, type or print as much of the mathematics as possible. Handwritten material must be neatly lettered in black ink.

1. Clarification of characters

(1) Many handwritten letters, numbers, and special symbols look alike and are hard to identify. Especially troublesome cases are given in Table V. Each should be identified the first time it occurs in manuscript, and thereafter if any ambiguity is still possible. Write the identification in black pencil above the symbol or in the left margin. Special symbols are most efficiently identified by using the identification numbers given in Appendix F:

$E \leqslant 36$ MeV

Always identify handwritten script, german, and sans serif letters the first time they appear in manuscript.

(2) Typed or printed material has the advantages of legibility and consistent formation of characters, but some confusion is still possible. On many typewriters the letter l and the number 1 are the same, and the author must distinguish between them: loop the letter l by hand when it is used as a mathematical symbol and, as a safeguard, identify both symbols (as "lc ell" and "one") the first time they appear. Similar precautions should be taken to distinguish between a capital O and a zero and between a capital X and a multiplication sign.

2. Roman versus italic type

(1) According to conventional practice, latin letters used as mathematical symbols are set in italic type to distinguish them from ordinary roman text. The typesetter is therefore instructed to set in italic type all unmarked latin letters that are obviously not words:

For $2x_r e^x = 0$, we obtain

will automatically be set as

For $2x_r e^x = 0$, we obtain

Authors should mark a letter for italic type (by underscoring in pencil) only if the letter might be mistaken for a word:

When $\underline{a}$ is a number dependent on...

(2) Since words will automatically be set in roman type, authors should mark words for roman type (by circling in black pencil) only in contexts in which they might be mistaken for symbols:

The values of s_{in} and s_{out} both increase with...

clearly should be set as

The values of s_{in} and s_{out} both increase with...

(3) Some latin letters, considered abbreviations of words, are properly roman instead of italic—for example, chemical symbols (O, Ne), most multiletter abbreviations (fcc, ESR, exp, sin), and most units of measure (K, Hz). But the editorial staff of the journal is trained to spot these, and authors need not mark them for roman type unless confusion is especially likely:

m_{Ne}, $(Res)x$

The marking of the first example makes it clear that the subscript means "neon," not Ne ($N \times e$). The marking of the second example identifies the function as the residue of x (Res x) instead of the real part of sx (Re sx).

3. Boldface type

(1) Indicate boldface by a single wavy underline in black pencil:

$\underset{\sim}{k} \cdot \underset{\sim}{p}$, $\underset{\sim}{\nabla} \times \underset{\sim}{A}$

TABLE V. Handwritten symbols requiring identification. The identification numbers in parentheses in column 2 are taken from Appendix F. "Typeset" versions of latin letters (column 3) are in italic type, the type style appropriate in most mathematical contexts.

Symbol	Identification (No.)	As typeset	Symbol	Identification (No.)	As typeset
$\mathcal{A}$	cap aye	A	ψ	lc psi	ψ
a	lc aye	a	Ψ	cap psi	Ψ
α	lc alpha	α			
$\propto$	proportional to (R10)	$\propto$	ϕ	lc phi	ϕ
∞	infinity (M1)	∞	Φ	cap phi	Φ
			Σ	cap sigma	Σ
c	lc cee	c	Σ	summation (Q29)	Σ
C	cap cee	C			
			s	lc ess	s
|	vertical bar (B15)	|	S	cap ess	S
/	solidus (Q18)	/			
′	prime (D15)	′	V	cap vee	V
1	one	1	v	lc vee	v
ℓ	lc ell	l	ν	lc nu	ν
e	lc ee	e	γ	lc gamma	γ
			υ	lc upsilon	υ
$\in$	an element of (R28)	$\in$	u	lc you	u
ϵ	lc epsilon	ϵ	μ	lc mu	μ
ε	eh (P7)	ε			
K	cap kay	K	W	cap double-you	W
k	lc kay	k	w	lc double-you	w
κ	lc kappa	κ	ω	lc omega	ω
n	lc en	n	x	lc ex	x
η	lc eta	η	X	cap ex	X
			×	multiplication sign (Q8)	×
°	degrees (M15)	°	χ	lc chi	χ
o	lc oh	o			
O	cap oh	O	z	lc zee	z
0	zero	0	Z	cap zee	Z
			2	two	2
ρ	lc rho	ρ			
p	lc pee	p	$\langle\rangle$	angular brackets (B19, B20)	$\langle\,\rangle$
P	cap pee	P	<,>	less than, greater than (R11, R12)	$<, >$
π	lc pi	π	†	dagger (D13)	†
Π	cap pi	Π	+	plus (Q1)	+
Π	product symbol (Q30)	Π			

will be typeset as

$$\mathbf{k}\cdot\mathbf{p},\ \nabla\times\mathbf{A}$$

Note that latin letters marked with a wavy underline will be set boldface roman, to distinguish them further from lightface italic. Dots and multiplication signs between letters marked for boldface will also be set boldface.

(2) Boldface is used for three-vectors, dyadics, some matrices, tensors without indices, etc. It is inappropriate for four-vectors (k), vectors represented by a typical component, such as x_i for $\mathbf{x} = (x_1, x_2, x_3)$, and the magnitude of a vector, H for $\mathbf{H}$. Subscripts attached to a three-vector should not be boldface unless they would be so as main characters:

$\underset{\sim}{k}_n$

is correctly marked, to become $\mathbf{k}_n$. When it is essential to distinguish between vectors and tensors, sans serif may be used for tensors.

(3) Some physics journals avoid boldface and represent three-vectors with an overhead arrow: $(\vec{k}\cdot\vec{p})$. Then dyadics may be represented by a double-headed arrow ($\overleftrightarrow{k}$), and matrices by an underline ($\underline{k}$). Note that latin letters embellished with arrows will be set lightface roman. Examine a recent issue of the journal to check the details.

4. Subscripts and superscripts

(1) Subscripts and superscripts attached to a symbol are normally set flush against the symbol and should so appear in manuscript:

A_i^{α}, m'_{12}, $^{238}_{92}U$

If they are to be set staggered, explicitly note the exception in black pencil in the left margin:

set $T_{\lambda 0}{}^{\mu}$ set $A^{-1}{}_{mn}$

(2) Clarify subscripts and superscripts with a caret if your word processor does not distinguish them, and whenever there is any possibility of mistaking their extent:

For $\delta_{r,s}$ we obtain

Draw the caret in black pencil. Do not write

$\delta_{A,s}$

which looks as if the carets were to be typeset.

(3) Clarify multilevel indices in black pencil:

R_{i_1}, N^{xyz}, g^{lm}.

Indices of this type are sometimes difficult to typeset and, once typeset, sometimes difficult to read. Use simpler alternatives if possible. For example, if a_n is the nth member of a series, then the n_1th member has to be a_{n_1}; but the z component of the vector H_c should be written $\underline{H}_{cz}$, since c_z has no meaning. Similarly, the square of H^0 should be written $(\underline{H}^0)^2$, not $\underline{H}^2$.

More than two levels of indices, as in $A^{a_{n_1}}$, are impractical and unreadable, and should be avoided.

(4) Subscripts and superscripts that precede a symbol should be marked to be spaced off whenever closing up might be misleading:

$3\gamma_{k^2}F_1(x)$, $5p^6{}^5S_{1/2}$.

C. DISPLAYED EQUATIONS

Display all numbered and complicated unnumbered equations on separate lines set off from the text above and below. "Complicated" equations are equations hard to accommodate within running text. These include equations longer than about 25 characters,

$$F_0 = N_1[A(C/(n)) + K(C(n))C(n^2) + \cdots], \qquad (1)$$

and equations that contain built-up fractions, matrices or matrixlike expressions, multilevel indices, or integral, summation, or product signs with limits:

$$\alpha = \frac{B(E_0) + c}{f_1 + f_2} f(\omega), \quad A = \begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix},$$
$$\hat{\beta} = \sum_{i=1}^{n} P_i. \qquad (2)$$

1. Multilinear equations

(1) If a displayed equation will not fit on one line, break the equation according to the following models:

$$\langle k+q|V_0|k\rangle = \langle k+q|V(r,r_0)\sigma(r_0,r)d\tau|k_0\rangle_0 + \langle k+q|v(r-r_0)\sigma(r_0,r)d\tau_0|k_0+q\rangle \times \langle k+q|2N_1|k_0\rangle + \langle k+q|2N_2|k_0\rangle, \quad (3)$$

$$(\hbar\Gamma_{nk} - \hbar\omega_c)\langle nk|f|n+1,k\rangle = 2le^n E_0(1-e^{-s})(n/2)^{1/2}(n-1)^{1/2}f_{nk}. \quad (4)$$

Operators and signs of relation begin continued lines. When a product is continued from line to line, as in Eq. (3), start the continuation with a multiplication sign.

(2) Align signs of relation in

$$R = (2\pi)^{N/4}|\chi|^{-1/4}\exp(-\tfrac{1}{4}\chi_{ij}\hat{q}_i\hat{q}_j) = \tfrac{1}{2}a_{ij}\hat{q}_i\hat{q}_j + b_i\hat{q}_i + c \qquad (5)$$

and

$$S(\mathbf{k},0) \simeq 1 - \bar{\eta}^2, \ \mathbf{k}\neq 0 \quad \simeq 0, \ \mathbf{k}=0 \qquad (6)$$

or, alternatively,

$$S(\mathbf{k},0) \simeq 1 - \bar{\eta}^2 \ (\mathbf{k}\neq 0) \quad \simeq 0 \ (\mathbf{k}=0). \qquad (7)$$

(3) The journals published by the Institute and its Member Societies are normally printed with two columns per page. Occasionally, when multilinear equations are very long, or when equations contain large matrices or long fraction lines, it is better to print across the page, in a single "wide" column. Authors should try to avoid the need for this, however, since it always makes the paper harder to read. If possible, define the component parts of such long equations in terms of appropriate symbols. In any case, the decision to set in a one- or two-column width should be left to the editorial office.

2. Equation numbers

(1) Only displayed equations may be numbered.

(2) The preferred style is to number equations consecutively throughout the text with arabic numerals in parentheses: (1), (2), (3), etc. Numbering by section is also acceptable, if the section number is made part of the equation number: (2.1), (2.2), (2.3), etc. In appendixes use the numbering sequence (A1), (A2), (A3), etc.

(3) Place equation numbers flush with the right margin. Leave a space at least two characters wide between an equation and its number.

(4) An equation number should be centered beside a group of equations identified by one number, as in Eqs. (2), (6), and (7) on this page. It should be aligned with the last line of a multilinear equation, as in Eqs. (3)–(5).

3. Built-up fractions, slashed fractions, and negative exponents

(1) A fraction can be represented in three alternative ways: "built up" with a fraction line,

$$\frac{x+y}{z},$$

or "slashed" with a solidus,

$(x+y)/z$,

or with negative exponents,

$(x+y)z^{-1}$.

In running text one of the last two forms must invariably be the choice, since built-up fractions will not fit. In displayed equations, use the slashed form or negative exponents for short, simple fractions, but use the built-up form for fractions that are long and complex. That is, write

$$pq^2/r + (n/y)^2 = 0$$

or, better,

$$(pq^2/r) + (n/y)^2 = 0$$

or, better still,

$$pq^2r^{-1} + n^2y^{-2} = 0$$

but

$$\alpha = \frac{B(E_0) + c}{f_1 + f_2} f(\omega)$$

is easier to read than

$$\alpha = [B(E_0) + c](f_1 + f_2)^{-1} f(\omega)$$

or

$$\alpha = \{[B(E_0) + c]/(f_1 + f_2)\} f(\omega).$$

(2) Do not mix built-up and slashed forms unnecessarily within one equation. Write

$$\frac{a}{b} = \frac{B(E_0) + c}{f_1 + f_2} f(\omega)$$

instead of

$$a/b = \frac{B(E_0) + c}{f_1 + f_2} f(\omega).$$

On the other hand, a built-up fraction within the numerator or denominator of another built-up fraction is ungainly and hard to set. Write

$$B' = \frac{[3J/(J+1)]T_N m^2}{En - Bn^2 b^2 n^2 T_N}$$

and, similarly,

$$A = \frac{x}{y} \begin{pmatrix} (a+b)/n & 0 \\ 0 & (a+c)/n \end{pmatrix}.$$

Use of a negative exponent is often the best alternative when slashing fractions within built-up fractions would be very awkward:

$$B = \frac{[3J/(J+1)]T_N m^2}{En - Bn^2 - n^2 m^2 T_N} \left(\frac{B(E_0) + c}{f_1 + f_2} f(\omega) \right)^{-1}.$$

(3) As a rule, use built-up fractions in displayed equations containing integral, summation, or product signs. In displayed equations these signs are usually large, and therefore no particular economy results from using the solidus. Write

$$\frac{a}{b} = \int_0^\pi dx \quad \text{and} \quad \frac{a}{b} = \sum_{i=1}^{\infty} a_i$$

instead of

$$a/b = \int_0^\pi dx \quad \text{and} \quad a/b = \sum_{i=1}^{\infty} a_i.$$

(4) Always use slashed fractions in subscripts and superscripts:

$$\int_z^{\pi/2} \left(\frac{t - z}{\tau^{-\alpha/(1-\alpha)}} \right)^{3/2} dt.$$

(5) Any rational fraction can be put on one line in the special upright form, for example, $\frac{1}{4}$. This form is awkward in subscripts and superscripts [see point (4) above]; elsewhere, use the upright form instead of forms with a solidus as often as possible. Write $\frac{1}{3}x$ instead of $x/3$, $(1/3)x$, or $1/3\,x$; never write $1/3x$ unless you mean $1/(3x)$. Write

$$\sin(\tfrac{1}{3}x) \text{ and } \tfrac{1}{3}\sin x$$

instead of

$$\sin(x/3) \text{ and } (\sin x)/3;$$

never write $\sin x/3$.

(6) When using the solidus, make sure that your meaning is unambiguous:

$$a/b + c \text{ means } (a/b) + c$$

but use the parentheses, or write $ab^{-1} + c$, to allay any doubts. Never write

$$a/b/c;$$

write instead

$$(a/b)/c \text{ or } a/(b/c)$$

(7) Make sure that the fraction line clearly delimits the numerator and denominator of a built-up fraction. Does

$$\ln \frac{a}{b} \text{ mean } \frac{\ln a}{b} \text{ or } \ln\left(\frac{a}{b}\right)?$$

Do not leave the resolution of such ambiguities to copyeditors.

4. Integral, summation, and product signs

In running text, integral, summation, and product signs cannot be full sized, and symbols attached to them must always be subscripts and superscripts: $\int_C$, $\Sigma_{i=1}$, Π_a. In displayed equations, integral, summation, and product signs can be full sized, and there is ample room for symbols above or below summation and product signs:

$$\int_C \sum_{i=1} \prod_a$$

D. RECOMMENDED NOTATION

1. Parentheses

(1) According to accepted convention, one works outward with parentheses according to the scheme

$$\{[(\ )]\}$$

Boldface parentheses are available; once the above scheme is exhausted, repeat the sequence in boldface. Also use boldface parentheses to enclose the argument of a function if the argument itself contains parentheses.

(2) Small parentheses and brackets are available for use in subscripts and superscripts. Oversize parentheses and brackets are available for use in displayed equations around expressions containing built-up fractions or integral, summation, or product signs.

(3) In general, too many parentheses are better than too few. But wholesale use of parentheses obscures rather than

clarifies, and—especially in displayed equations—wastes labor and space. All of the parentheses in the following example are extraneous:

$$\left[\left(\frac{(l+2)}{a^2}\right)+\left(\frac{2x^2}{(0.01)\pi/a}\right)\right]=0.$$

(4) The introduction of special brackets that do not simply group, but also define, what they enclose does not affect the usual scheme:

$$[|\hbar(\langle E\rangle^{1/2}+m)|^2-\Delta S\,]^{-1}.$$

But if any of the common parentheses or brackets are used with a special meaning, they should not then be used for grouping:

$$\tfrac{1}{2}\{-i(L_1[L_2,L_3]+K_j)\}$$

In such cases, it is wise to identify the special brackets when they first appear to assure copyeditors that the unusual ordering is no slip.

(5) The following special uses of parentheses and brackets are recommended:

plane, or set of parallel planes	(111)
point designated by coordinates	(x,y,z)
vector written in components	(H_x,H_y,H_z)
function of a function	$F(f(x))$
direction	[111]
class (group) of symmetry-equivalent planes	{111}
class (group) of symmetry-equivalent directions	⟨111⟩

2. Mathematical functions set in roman type

(1) Standard abbreviations for functions set in roman type are given in Appendix D. Apart from these standard functions, the use of multiletter symbols for single quantities (such as "TKE" for total kinetic energy, or "BR" for branching ratio) is improper.

There is usually no need to mark the standard functions for roman type [see point (3) of Sec. IV B 2]; but take care, when using such functions, to respect the following conventions.

(a) A function is closed up with its argument:

$\mathrm{Tr}Q$, $\tan(\eta^2/\mu)$

(b) The function of a product may be written without parentheses:

$\sin xa$ means $\sin(xa)$.

But put parentheses around the product whenever there is a chance of confusion:

$\sin(x^2a^{3/2})$, $\sin(\frac{1}{2}x)$.

Note, however, that an argument is assumed to stop as soon as another function appears:

$\sin x\cos a$ means $(\sin x)\cos a$.

(c) $\sin x/a$ is ambiguous. Write $(\sin x)/a$ or $\sin(x/a)$, depending on the intended meaning.

(d) An argument stops at a plus or minus sign:

$\sin x + a$ means $(\sin x) + a$

(e) A plus or minus sign should never directly follow a function. Write

$\sin[-(x+a)]$ rather than $\sin -(x+\mathrm{a})$

(2) The decision to use exp or its italic alternative e depends on the nature of the argument. Use e if the argument is simple enough to make a readable superscript:

$e^{B/T}$, e^{-x^2}

If the argument is long, or contains complicated indices, a built-up fraction, or an integral, summation, or product sign, use exp instead:

$$\exp[-h(t)+(\omega-\epsilon)t\,],\ \exp(x_{\nu\nu}^2a^{3/2}),$$

$$\exp\left(\frac{a+bx}{c+dy}\right),\ \exp\left(-\sum_{R,S}h_{RS}(0)\right).$$

Be consistent. Try not to use exp and e in proximity or for the same argument.

3. Radicals and bars over groups of symbols

The "roof" of a radical or a bar can be set over simple expressions, as in $\sqrt{a}$, $\sqrt{a+b}$, and $\overline{AB}$, but may be awkward over complicated ones. An exponent 1/2 or special brackets may then be used instead: $(a^2+b^2)^{1/2}$, $\langle A^nB\rangle_{\mathrm{av}}$. A bare, "unroofed" radical may also be used, but always with a liberal use of parentheses to avoid ambiguity. Write:

$\surd(x^3a)$ or $(\surd x^3)a$,
$\surd(x^3/a)$ or $(\surd x^3)/a$,
$\surd(x^3+a)$ or $(\surd x^3)+a$,

depending on your meaning. Clearly, as substitutes for roofed radicals, forms with an exponent 1/2 are usually less troublesome and more readable than forms with a bare radical.

4. Multiplication signs

(1) Use a multiplication sign for the vector product of three-vectors:

$\mathbf{\nabla\times A}$ (not $\mathbf{\nabla\wedge A}$).

As a rule, do not use multiplication signs for simple products. Write

$2ab$ instead of $2\times ab$ or $2a\times b$

Exception is made for the continuation of a product from line to line [see point (1) of Sec. IV C 1], and for the following special cases:

3.4×10^{-6} eV, $3\times2\times1$ mm

$1\times3\times5\times\cdots\times(2n-1)$, $2f\times\frac{1}{4}g$.

(2) Centered dots may be used in compound units: $4\,\mathrm{g\cdot cm^2\cdot s^{-2}}$. Their principal use is in inner products of vectors, dyadics, and the like:

$\mathbf{k\cdot p}$, $\mathbf{l\cdot g\cdot s}$.

Do not use dots for simple products, or for any other kind of multiplication. Write

$2ab$ instead of $2\cdot ab$ or $2a\cdot b$.

5. Mathematical terms

The American Institute of Physics strongly recommends the usage of the following symbols:

approximately equal to	$\approx$ or $\simeq$
proportional to	$\propto$
tends to	$\rightarrow$
asymptotically equal to; of the order of magnitude of	$\sim$
of the order of (in the mathematical sense)	$O(\ \ )$
complex conjugate of A	A^* (not $\overline{A}$)
Hermitian conjugate of matrix A	$A^\dagger$
transpose of matrix A	$\tilde{A}$, A^{T}
unit vector $\mathbf{k}/k$	$\hat{\mathbf{k}}$

Customary usage in physics (in contrast to mathematics) is to denote complex conjugation by an asterisk rather than an overbar, and Hermitian conjugation by a superscript dagger (not a plus sign!) rather than an asterisk. Transposition should be denoted by a superscript tilde, or, better, a roman T, not an overtilde.

V. Figures – *SEE ADDENDUM* –

Figures play a significant role in the expression of scientific ideas. A single well-prepared figure can contribute immeasurably to the clarity of the text, and high standards of presentation are therefore particularly important. Authors themselves must assume full responsibility for the preparation of acceptable figures, because illustrators are not available for this purpose in the editorial offices. Follow closely the detailed instructions given below for the preparation of line drawings and the presentation of photographs. Remember that unacceptable figures are a common cause for delay in the publication of a paper.

A. GENERAL INSTRUCTIONS

(1) Design figures for reduction to the journal column width (consult a recent issue of the journal for the dimensions). One and a half or two columns may be used when required.

(2) Group the figures in order at the end of the manuscript, after the collected captions.

(3) Identify each figure with the figure number and authors' names. Write the identification where it will not be reproduced, preferably at the bottom of the figure—never within the figure itself, and if possible not on the back of the figure. To accommodate the information that may be added later in the editorial office, leave a space at least 50 mm (2 in.) deep across the bottom of the figure. Be sure the identification appears on all copies as well as on the originals. If the identification must be written on the back of a photograph, write lightly with a soft pencil so as not to make a visible depression that will show through to the face of the photograph. Indicate the correct orientation if there is a possibility of error (write "Top" in the top margin).

(4) Prepare related figures as a group, so that two or three may be printed either down one column or across two. Such an alignment is greatly facilitated if the figures are all the same size, or of common width for a vertical arrangement, or common depth for a horizontal arrangement. Assign the group of figures a common caption. If these figures are referred to separately, refer to them by lower-case letters in parentheses [(a), (b), (c), etc.] and draw the letters inside the figures at analogous locations.

(5) Protect figures against damage in transit. Usually the best way is to mail them flat, protected by heavy cardboard. If a drawing is folded, lines or symbols may be broken or spoiled by the crease. Never roll or fold photographs. Keep them free of clips, staples, or any pressure that might cause damage. Rolling oversize drawings and mailing them in a tube is not recommended; a better plan is to submit photographic reductions of large illustrations of a size that can be conveniently mailed flat.

B. LINE DRAWINGS

Line drawings use only lines and black areas on the white background. Variations in tone between the black and white extremes cannot be reproduced. Study recent issues of the journal to which the manuscript will be submitted for examples of acceptable drawings, and see Fig. 2, an example of a poorly prepared line drawing, and Fig. 3, a well-prepared drawing, for some common errors and ways to correct them.

(1) Line drawings should be made with black India ink on Bristol board, heavy smooth paper, or high-quality tracing cloth. For maximum black-and-white contrast use white material only. Do not use Mylar, tracing paper, or ruled coordinate paper. Drawings on board or heavy paper can be protected with an overlay of tissue paper fixed to the back of the drawing and folded over to the front. Glossy photographic prints of line drawings are very satisfactory provided they are sharply focused uniformly across the print.

(2) Draw lines, symbols, and letters that will withstand reduction to the journal column width. To this end:

(a) All lines must be black and have a solid, even, line weight. Gray or thin lines will break up or disappear in reduction. The material on which the figure is drawn is relevant: the less opaque the material, the longer must be the exposure time and therefore the darker must be the artwork.

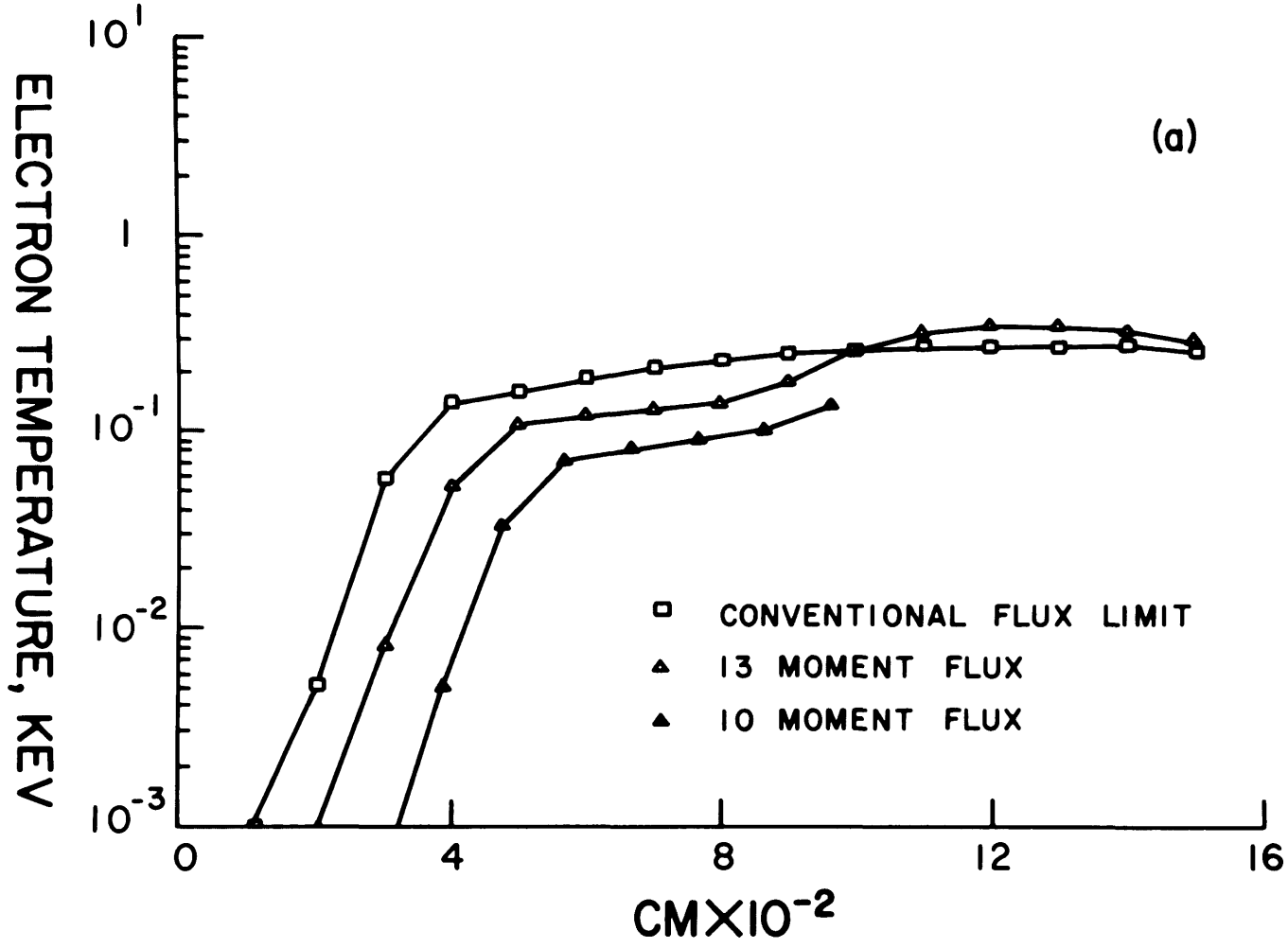
(b) Draw symbols and letters so that the smallest ones will not be less then 1.5 mm (1/16 in.) tall after reduction; symbols smaller than that may be illegible. For example, a figure 150 mm (6 in.) wide will be reduced to half its original height and width to fit a single journal column. Therefore the smallest symbols and letters should be drawn 3 mm (1/8 in.) high. If the detail to be shown does not permit symbols of this size, only a part of the figure should be included.

(c) Avoid gross disparities in the thicknesses of lines and in the sizes of symbols and letters. Open or half-closed symbols (○, △, ◩) tend to close up or become indistinct when reduced; draw them slightly larger than closed symbols (●, ▲, ■). (Open symbols with dots inside them fill in so easily upon reduction that they should not be used at all.)

To distinguish the principal lettering from the lettering in subscripts and superscripts, draw the principal lettering about one-third larger (approximately 2 mm after reduction) than the smaller lettering. More than two sizes of lettering are unnecessary. Give decimal points a diameter about 1.5 times the thickness of the lines in the lettering.

(d) Letters should not be so closely spaced that they run together in reduction. They should be simple in style, without serifs. Open parts of letters and numbers such as "e" and "6" should be large enough not to fill in on reduction. Handlettering is never acceptable. Most typefaces available on typewriters are also unsuitable. Mechanical lettering sets and stencils are strongly recommended.

(3) Graphs should be self-explanatory, their purpose evident without reference to the text. Indicate clearly what is being plotted, in both the horizontal and the vertical directions. Include appropriate units. Orient letters and numbers so that they may be easily read from the bottom or the right-hand side of the graph. Relevant nongraphic material, such



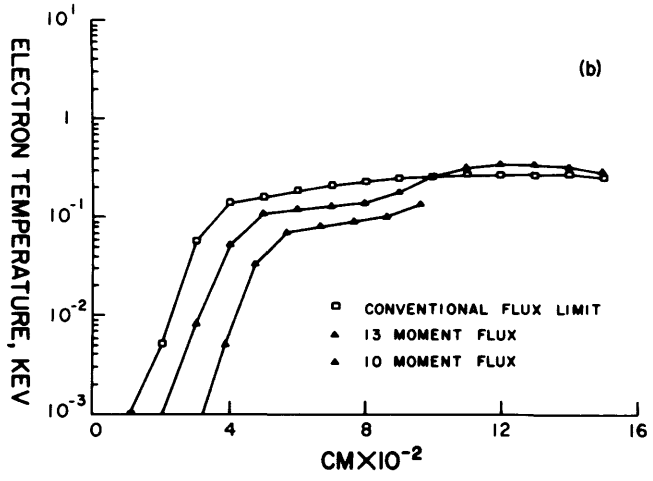
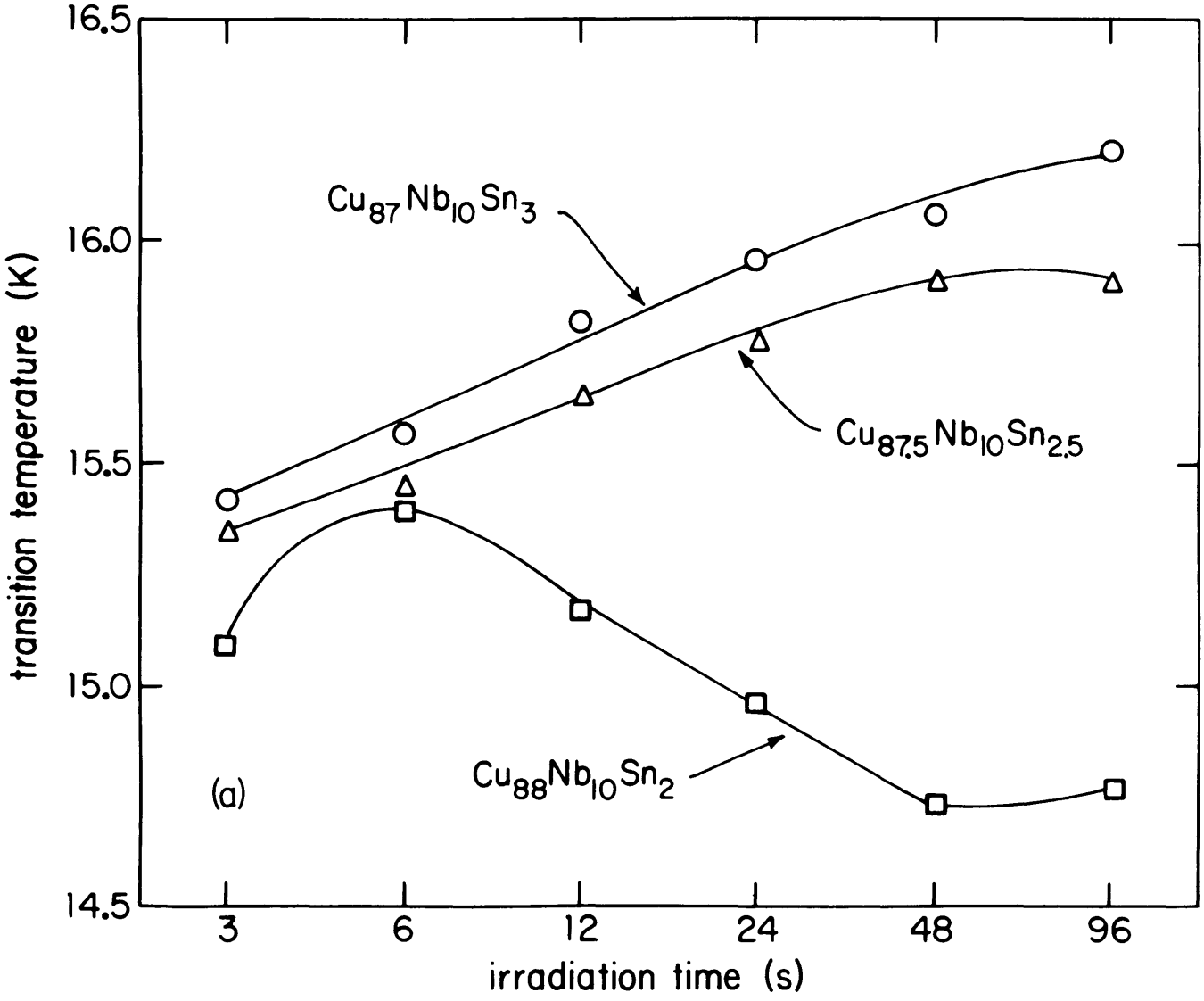


FIG. 2. A poorly prepared line drawing (a) actual size and (b) reduced to the journal column width. For uniform lettering, the axis labels should be diminished, and the lettering within the graph enlarged, to match the size of the axis numbers. The ordinate label is best written "electron temperature (keV)"; it should face the graph. The abscissa should be fully identified; the power of 10 should precede the unit (10^{-2} cm) or, better, be attached to the largest number on the axis (16×10^{-2}). The data symbols in this figure should be at least as large as the superscripts. As drawn, the open triangles tend to close on reduction, and ambiguity results. The ordinate extends unnecessarily and wastes space. The graph should be enclosed by four lines, each with ticks.



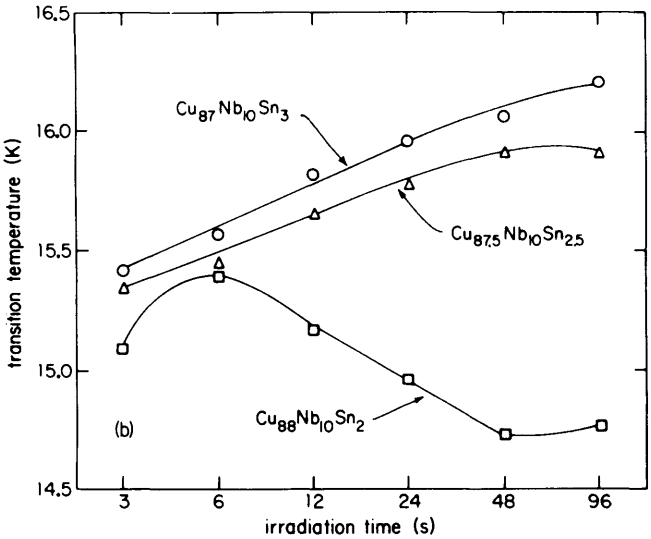


FIG. 3. A well-prepared line drawing (a) actual size and (b) reduced to the journal column width.

as the key to the symbolism in the graph, may be included within the confines of the graph frame if it will fit without crowding; otherwise put the explanatory material in the caption.

In captions, use available symbols (see Appendix F) to represent data points, but use words to identify curves (for example, "solid," "dashed," "dotted," "dot-dashed," etc.). A better alternative is to label curves with letters (A, B, etc.) and to refer to them by letter in the caption ("Curve A represents...").

The notation used in graphs should be standard and consistent with the notation used in the text. Write 0.1, not .1, 0·1, or 0,1. Do not capitalize letters indiscriminately: write

in units of q/a, not IN UNITS OF q/a

and

kinetic energy Ef (meV) not KINETIC ENERGY Ef (MEV)

Take care to preserve standard forms for symbols and abbreviations, as you would in text. Standard units should be well spaced off and enclosed in parentheses.

If possible, do not use powers of ten in axis labels: use instead the appropriate prefixes of the *Système International* (see Table IV). If powers of ten must be used, write for example

$$R(10^{-4}\Omega) \text{ or } 10^{4}R\ (\Omega).$$

Never write

$$R \times 10^{-4}\Omega \text{ or } R/10^{-4}\Omega,$$

because in these forms it is not clear whether the scale numbers have been or are to be multiplied by 10^{-4}. Better still, attach the power of ten to the largest number on the axis: 8×10^{-4}.

Whenever possible, use integer numbers on the axis scales of figures (1, 2, 3, or 0, 5, 10, not 1.58, 3.16, 4.75 or 1.5, 3.0, 4.5). If this is not feasible, then there must be a number both before and after the decimal point: Use 0.5, not .5, and 5, not 5., etc. Do not use unnecessary decimal places: 1.0, 1.5, 2.0 is acceptable, but not 1.00, 2.00, 3.00.

Coordinate ruling should be limited in number to those necessary to guide the eye in making a reading to the desired degree of approximation. Ticks to indicate coordinate values, placed within all four sides of the graph, increase readability, and are recommended. Closely spaced coordinate rulings are appropriate only for computation charts. It is often impossible in a journal to make a graph large enough to preserve accuracy of the data beyond two significant figures. If that accuracy is not sufficient for your purposes, present the data as a table.

Graphs with large blank areas, or large areas containing only nongraphic material, are unacceptable; use only the ranges of coordinates for which there are data. If similar quantities are plotted several times, use shifted ordinate scales for each plot and enclose the plots in one large rectangle, not in separate boxes, thereby saving space. Isometric drawings giving the illusion of three dimensions to the family of curves are often better.

(4) In diagrams of electrical circuits, the values of resistances, inductances, etc. and component designations should be lettered directly on the diagram. A separate parts list in the caption is then unnecessary, except for special or unusual components.

(5) "Shading" (that is, various shades of gray) in line drawings does not reproduce well. Diagonal lines, cross-hatched lines, or arrays of dots the size of the periods used in lettering (or larger) reproduce well. Even more convenient are the commercial products for applying coarsely textured or "Benday" screened areas in line art by peel-off or rub-on methods.

(6) Computer-drawn figures can now be made equal in quality to those drawn by a skilled draftsmen, and the same criteria should apply to them. In particular, lines should be dark, and of adequate width to survive reduction. Lettering should be simple, pleasing to the eye, in one typeface only and no more than two sizes. The slash through a zero to differentiate it from the letter O is unacceptable.

Joining every pair of adjacent experimental points is an easy solution but it may lead to curves that are too obviously a series of line segments or that are very "noisy." It is preferable to produce a curve by some smoother method, such as by the use of an analytical approximation, in which the calculated points may be as close as desired and only the lines joining them need appear.

(7) When correcting errors in a line drawing, either make the corrections on thin opaque tape (thick tape casts shadows that reproduce as spurious lines) or cover the error with paint, reletter, and cover both the paint and the new lettering with clear tape (exposed paint will flake).

C. CONTINUOUS-TONE PHOTOGRAPHS

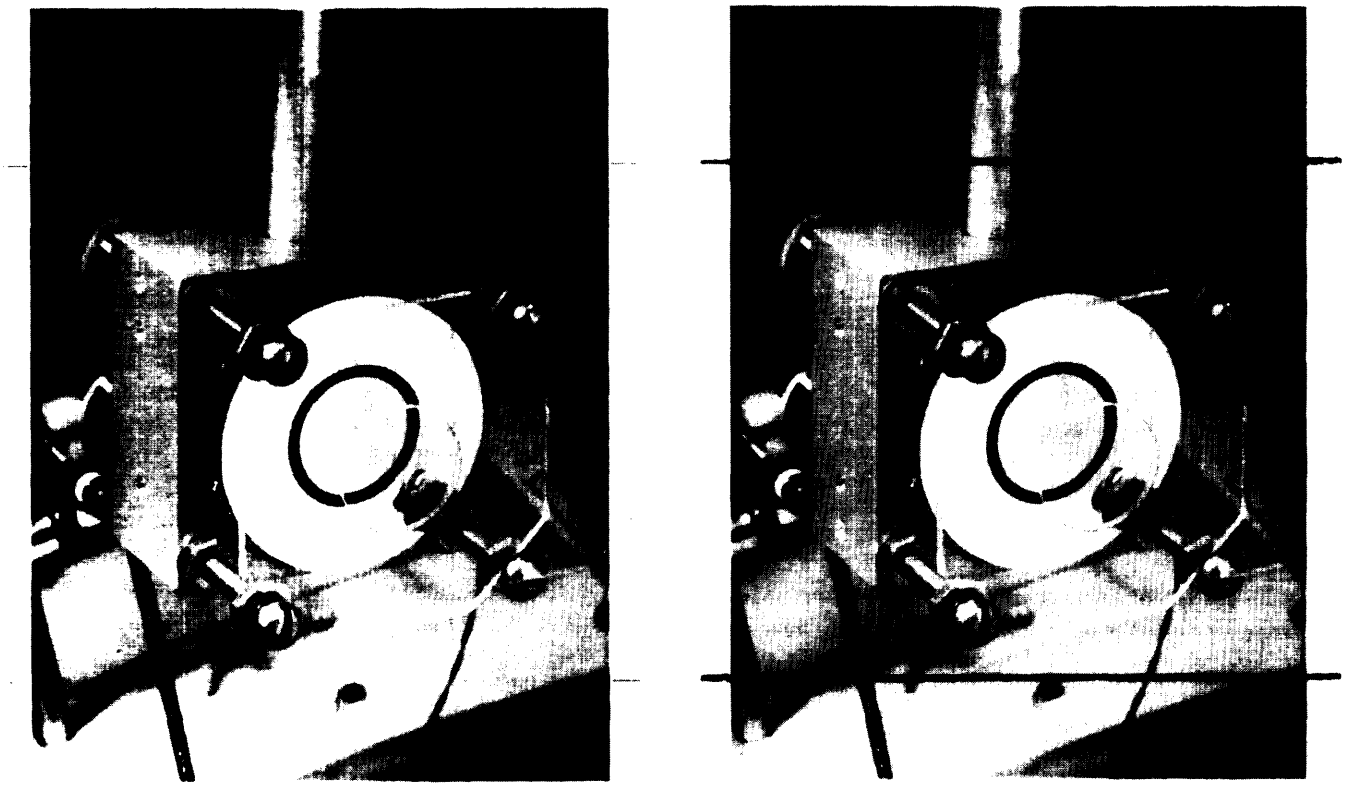
Continuous-tone photographs require half-tone reproduction. In this process the photograph is transferred to a printing plate as a pattern of dots. Variation of perceived tone is achieved by variation in the size of the dots; the largest dots produce the darkest areas and the smallest, the lightest. Naturally, the quality of the reproduction ultimately depends on the quality of the original.

(1) Submit photographs on glossy paper. Because contrast is often lost in reproduction, the photograph should be printed with rather more contrast than is desired on the printed page. Photographs that have already been screened are unusable; interference between the pre-existing screen and the one imposed for reproduction results in a moiré pattern.

(2) As with line drawings, most photographs will be reproduced at the journal column width. For good results, submit original photographs of a larger size than this (say, 200×250 mm).

(3) Lettering used to identify components of a photograph should be large enough that it will be legible after reduction. The lettering should contrast with the background; that is, black lettering on a light ground, white lettering on a dark ground.

(4) If a photograph is to be cropped, mark for cropping as shown in Fig. 4(a). That is, put crop marks on the margin or mount, not on the photograph itself.



(a) (b)

FIG. 4. (a) Proper crop marking. Mark plainly at the edges of the photograph as shown, or on a transparent overlay. (b) Improper crop marking. Crop marks on the photograph itself force the printer to work inside the marks and thus to reproduce less of the photograph than was intended. The photograph is also unsuitable for future use.

(5) Photographs of apparatus in the laboratory are not usually instructive. A good line drawing of apparatus, amply and clearly labeled, is usually much more useful.

(6) Photomicrographs may carry an overlay sheet on which you indicate where the clearest reproduction is required. The printing process tends to collapse the scale of gray tones in a photograph, and without help of this kind the printer may choose to differentiate tones elsewhere in the photograph and lose contrast where you need it most. All such micrographs should carry an indication of the scale within the area to be reproduced. Designations such as "1000×" are to be avoided because the size of the printed figure is generally different from that of the submitted photograph. Indicate the orientation desired, for example, by writing "Top" on one margin of the print.

It is unwise to submit a unique original micrograph, or any unique photograph that is the only record of an experimental result.

(7) Most journals published by AIP and its Member Societies will publish colored illustrations, but only at the discretion of the editor and usually with substantial additional costs to be borne by the author. Before submitting a colored figure, consider whether the color adds significantly to the information that can be read from the photograph. Often a good black and white photograph is adequate. Consult the editor first.

Under suitable conditions it is sometimes possible to include microfiches, flexible sound recordings, or other material in pockets pasted to the inside of the back cover of the journal. Again, consult the editor beforehand.

D. COMBINATION FIGURES

A "combination figure" contains both a continuous-tone area and a line illustration. To prepare a combination figure for offset printing, two processes must be used, one for the halftone and one for the line art. Whenever possible, submit a simple continuous-tone photograph instead, with the line art drawn directly within its area.

If a combination figure must be submitted, then:

(1) Submit the linear material on an acetate overlay attached to the photograph.

(2) Prepare the original figure so that, after reduction, there will be at least 4.5 mm (3/16 in.) of white space between the line and tone areas.

– SEE ADDENDUM –

APPENDIX A: STATEMENTS OF EDITORIAL POLICY FOR AIP AND MEMBER-SOCIETY JOURNALS

AIP Conference Proceedings

Publishes AIP Member-Society and other appropriate conference proceedings in a series of clothbound volumes. Published by AIP.

Tim Taylor, American Institute of Physics, 335 E. 45 St., New York, NY 10017

American Journal of Physics

Published by AIP for the American Association of Physics Teachers. Devoted to meeting the needs and interests of college and university physics teachers and students by focusing on the instructional and cultural aspects of physics. Contains feature articles that describe novel approaches to laboratory and classroom instruction and other areas of physics pedagogy.

Robert H. Romer, Editor, 222 Merrill Science Building, Amherst College, Amherst, MA 01002

Applied Optics

Published by the Optical Society of America. Contains original papers in applied optics and related fields, and is of particular interest to engineers and applied physicists. Emphasis is on "modern" optics. Includes articles, letters, and rapid communications on the applications of facts, principles, and methods of optics.

William T. Rhodes, Editor, School of Electrical Engineering, Georgia Institute of Technology, Atlanta, GA 30332

Applied Physics Letters

Provides timely, short reports of important and new findings in applied physics, and rapid dissemination of brief reports on new developments in fields regularly covered by *Journal of Applied Physics*. Special topics, such as high T_c superconductors, can be given particularly rapid publication. Published by AIP.

Hartmut Wiedersich, Editor, Argonne National Laboratory, P.O. Box 8296, Argonne, IL 60439

The Astronomical Journal

Published by AIP for the American Astronomical Society. Contains original observations and research in all branches of astronomy. High-quality photoreproductions of star plates and spectrograms are a part of this publication.

Paul Hodge, Editor, Department of Astronomy, University of Washington, Seattle, WA 98195

The Astrophysical Journal

Published by the University of Chicago for the American Astronomical Society. Published three times monthly (in two parts), this publication contains articles on all aspects of astrophysics and astronomy, and related sciences that are primarily applicable to astronomical objects.

Helmut A. Abt, Managing Editor, Kitt Peak National Observatory, Box 26732, Tucson, AZ 85726-6732

Bulletin of the American Astronomical Society

Published by AIP for the American Astronomical Society. Contains abstracts of papers to be given at meetings of the Society and annual observatory reports.

Peter B. Boyce, Editor, American Astronomical Society, 2000 Florida Avenue N.W., Washington, D.C. 20009

Bulletin of The American Physical Society

Published by AIP for The American Physical Society. Contains abstracts of papers to be given at Society meetings and information on Society events and programs.

W. W. Havens, Jr., Editor, The American Physical Society, 335 E. 45 St., New York, NY 10017

Computers in Physics

Published six times annually, this publication contains news and feature articles on computers and their applications in physics, as well as peer-reviewed journal articles. Both sections of this magazine-journal combination contain material on the use of main frames and personal computers in pedagogy, in numerical simulation, in the collection and reduction of experimental data, and in other applications.

Robert R. Borchers, Editor, Lawrence Livermore National Laboratory, P.O. Box 5512, Livermore, CA 94550

Current Physics Index

A quarterly and cumulative annual index to all primary publications of the AIP and its Member Societies. Each quarterly issue contains a three-month accumulation of abstracts organized by subject and alphabetical author indexes. The annual cumulation omits the abstracts, but gives the complete title and byline of every paper published, alphabetically under each author's name and for up to four subject categories. The ICSTI International Classification Scheme for Physics is used. Published by AIP.

Geophysical Research Letters

Contains short, original communications on the latest research in geophysics. This monthly publication presents fast-moving areas of geophysics in a style that makes the results meaningful to scientists from diverse geophysical disciplines.

For the address of current editors, write: American Geophysical Union, 2000 Florida Avenue N.W., Washington, D.C. 20009

The Journal of the Acoustical Society of America

Published by AIP for the Acoustical Society of America. Contains reports of the latest coverage in acoustics, in both theoretical and applied areas. Coverage includes such topics as architectural, physiological, and psychological acoustics, music, voice, speech, ultrasonics, radiation, vibration, underwater acoustics and aeroacoustics, bioacoustics, statistical methods, and instrumentation. Three supple-

ments appear annually; two are programs of meetings of the Society; the third is References to Contemporary Papers on Acoustics.

Daniel W. Martin, Editor, 7349 Clough Pike, Cincinnati, OH 45244

Journal of Applied Physics

Largest general publication medium for research results in applied physics. Contains material applying physics to industry and other sciences. Active fields represented include semiconductor properties and devices, lasers and their applications, magnetic and dielectric materials, plasmas, high-polymer physics, and many more. Published by AIP.

Steven J. Rothman, Editor, Argonne National Laboratory, P.O. Box 8296, Argonne, IL 60439

The Journal of Chemical Physics

Articles report advances in theoretical and experimental research dealing with the area of overlap between physics and chemistry. Letters to the Editor section contains rapid communications, preliminary reports of findings of unusual importance, plus comments on work published in the journal. Published by AIP.

John C. Light, Editor, Department of Chemistry, The University of Chicago, Chicago, IL 60637

Journal of Geophysical Research

One of the most widely cited journals in the earth sciences. Contains original contributions on the physics and chemistry of the earth and solid planets; their oceans and atmospheres; and space physics. JGR is published four times each month.

For the address of current editors, write: American Geophysical Union, 2000 Florida Avenue N.W., Washington, D.C. 20009

Journal of Lightwave Technology

Published jointly by the Optical Society of America and the Institute of Electrical and Electronic Engineers.

Donald B. Keck, Editor, Corning Glass Works, Sullivan Park FR29, Corning, NY 14830

Journal of Mathematical Physics

Emphasizes mathematical techniques as applied to problems of physics and engineering. Contains results of original work in fields of current interest to theoretical and mathematical physicists. Published by AIP.

Lawrence C. Biedenharn, Jr., Editor, Department of Physics, Duke University, 23 Science Drive, Durham, NC 27706

Journal of the Optical Society of America A and B

Published by the Optical Society of America. These two journals contain concise accounts of experimental and theoretical investigations that contribute to new knowledge or understanding of optical phenomena, principles, or methods. *Journal of the Optical Society of America A* emphasizes image science and is the general journal for basic materials. *Journal of the Optical Society of America B* emphasizes laser spectroscopy and modern quantum optics.

Harrison H. Barrett, Editor, J. Opt. Soc. Am. A, Optical Sciences Center, University of Arizona, Tucson, AZ 85721

Paul F. Liao, Editor, J. Opt. Soc. Am. B, c/o Optical Society of America, Manuscript Office, 1816 Jefferson Place N.W., Washington, D.C. 20036

Journal of Physical and Chemical Reference Data

A joint publication of AIP and the American Chemical Society for the National Institute of Standards and Technology. Compilations and critical reviews of evaluated reference data produced by the National Standard Reference Data System of the National Institute of Standards and Technology and other groups.

David R. Lide, Jr., Editor, National Institute of Standards and Technology, Washington, D.C. 20234

Journal of Rheology

Published by AIP for the Society of Rheology. Its purpose is to publish analysis, experimental, and numerical work on deformation and flow of materials. Both theoretical and applied work are of interest.

Arthur B. Metzner, Editor, Department of Chemical Engineering, University of Delaware, Newark, DE 19716

Journal of Vacuum Science and Technology A and B

Published by AIP for the American Vacuum Society. These journals publish reports of original research and review articles concerned with fundamental and applied vacuum science. JVSTA contains articles on thin films, surfaces, vacuum technology, and materials and processes. JVSTB emphasizes microelectronics processing and phenomena.

G. Lucovsky, Editor JVSTA, Department of Physics, North Carolina State University, Raleigh, NC 27695

T. M. Mayer, Editor JVSTB, Department of Chemistry, University of North Carolina, Chapel Hill, NC 27514

Medical Physics

Published by AIP for the American Association of Physicists in Medicine. Contains original articles and material that broadly reflects the utilization of physics in problems arising from the practice of medicine. Reflects the growth and expansion of the field of medical physics. Includes reports on the activities of the Association.

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Fred Ribe, Editor, Physics of Fluids B, College of Engineering, 356 Benson Hall, BF20, University of Washington, Seattle, WA 98195

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Clifford E. Swartz, Editor, Department of Physics, SUNY, Stony Brook, NY 11794

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A semipopular publication that contains articles and news of interest to the reader with only a general interest in physical science, as well as the professional physicist. Contains feature articles that cover a wide range of topics and interests. Published by AIP.

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For the address of current editors, write: American Geophysical Union, 2000 Florida Avenue N.W., Washington, D.C. 20009

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Published by The American Physical Society through AIP. Provides comprehensive, scholarly reviews of significant topics as well as perspectives and tutorial articles in rapidly developing areas of physics. Seeks to enhance communication between physicists in different fields and between experienced researchers and the beginning graduate student.

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For the address of current editors, write: American Geophysical Union, 2000 Florida Avenue N.W., Washington, D.C. 20009

APPENDIX B: CORRECT OR PREFERRED SPELLINGS OF FREQUENTLY OCCURRING WORDS

Abelès
Abelian
aberration
ab initio
abscissa
absorbance
absorbency
absorptance
acknowledgment
acnode
adatom
ad hoc
adiabatic
adsorption
aerospace
à la
Albuquerque
Alfvén
aliovalent
aluminum
among (or amongst)
Ampère
ampoule (or ampul)
analog
analyze
anelastic
anharmonic
anion
anomalous
anomaly
ansatz
antilogarithm
aperture
a posteriori
appendixes
approximant
a priori
aqua regia
aqueous
arclength
Arnol'd (or Arnold)
Arrhenius
asymmetry
asymptote
audio frequency
autoionization
auxiliary
Avogadro
axisymmetric
azimuthal

Bäcklund
backscatter
bakable
bakeout
band edge
band gap
bandhead
bandlimited
bandpass
band shape
band shift
band spectrum
band structure
bandwidth (but *d*-band width)
base line
baseplate
beamwidth
behavior
Bémard
benchtop
benefited
Bethe-Salpeter
bifilar
birefringence
Bitter (magnet)
blackbody
Bloch
blueshift
Bogoliubov (or Bogolyubov)
boiloff
Boltzmann
bona fide
Bose
boson
Bourdon (gauge)
boxcar
bradyon
branch point
Brillouin
breakup
bremsstrahlung
Bridgman
broadband
buildup
buret
burnthrough
Burgers (vector)
by-product

Cabibbo
canceled
canceling
cancellation
cannot
capacitance
caret
carryover
Cartesian
catalog
cathode
Cauchy
center
Čerenkov (or Cherenkov)
chalcogen
changeover
Chebyshev (or Tschebyscheff)
chimeral
chiral
chromic
Clebsch-Gordan
coaxial
Cockcroft
cohomology
collimate
collinear
combinatorics
comoving
complection
concomitant
consistent
controlled
cooldown
cooperate
coordinate
Coriolis
corollary
corundum
Coulomb (adj)
coulomb (meas.)
Coulombic
counterclockwise
countercurrent
counterexample
counterion
counterstreaming
counterterm
countertorque
co-worker
cross-check
cross field
crosshatched
crossover
cross term
crunode
crystalline
crystallize
crystallographic
cumulant
cutoff
Czochralski

D'Alembertian
database
dead time
de Broglie
decalin
decane
decimet
decuplet
deexcitation
de Gennes
de Haas
de-ionized
Département (byline)
dependence
de Rham
de Sitter
desktop
detectable
determinant
Dewar
dew point
diabatic
diagonalizable
diagramed
diagrammatic
diametral
dichroism
diffusivity
digitize
dilatation
dilation
dilaton
dineutron
Diophantine
di-pion
Dirichlet
disalign
discernible
discrete
disk
divergences
Doppler
down-spin

echelle
echoes
Ecôle Supérieure (byline)
effect (noun)
eigenfunction
eigenvalue
eikonal
electroacoustical
electro-optical
end loss
end point
end wall
ensure
ergodic
étalon
Euclidean
exercised
explicitly
extremal
eyepiece

Fabry-Pérot
Faddeev
falloff
favorable
feedback
feedthrough
fermion
ferroelectric
ferrous
Feshbach
Feynman
filar
fitted
flash lamp
flatband
flattop
flow rate
fluence
fly-by (diagram)
Fock
focused
Fokker
formulas
formulational
Fourier
fractal
framework
Fréedericksz

freeze-out
free fall
Friedel
Fröhlich
fulfillment

Galilean
gasdynamic
gases
gauche
gauge
Gaussian
gedanken experiment (sing.)
gedanken experiments (pl.)
Gel'fand
Gell-Mann
gerade
Ginzburg-Landau
glovebox
gluon
Grüneisen
guideline
gyro-orbit
gyroperiod
gyroradius

hadrodynamics
Hafnian
halfway
Hamiltonian
Hausdorff
Heaviside
Hele-Shaw
helicon
helion
Hellmann
Helmholtz
Herglotz (function)
Hermite (polynomial, integration)
Hermitian (operator, conjugate, matrix, form)
heuristically
Higgsino
histogram
Hohlraum
homeomorphic
horsepower
Hückel
hybridization
hydrogenic
Hylleraas
hysteresis

idempotent
imbalance (noun)
inadvertently
inasmuch as
indexes (to book)
indices (to variable)
indicial
indispensable
infinitesimal
inflowing
infrared
input
inscattering
in situ
insofar as
in-state
Institut (Fr., Ger.) (byline)
integro-differential
inter-ion
interrelation
interstitialcy
intra-atomic
in vacuo
isentropic
isochoric
isochroic
isorrhopic
isosbestic
isotropic
Istituto (It.) (byline)

Jacobian
Jastrow
judgment

Kadomtsev–Petriashvili
Kirchhoff
Klein-Gordon
klystron
Kol'mogorov (or Kolmogorov)
Korteweg–de Vries
Kramers (doublet)
Kramers-Kronig
Kronecker
Kronig-Penney
Kubic (harmonic)
Kurşunoğlu

labeled
Laboratoire (byline)
Lagrangian
Laguerre
Landé
Langevin
Langmuir
Laplacian
Larmor
Laue
lead-in (adj.)
Lebesgue
lemma
Lennard-Jones
Levi-Cività
l'Hôpital's (rule)
Lie (group)
lifetime
lift-off
line shape
line shift
linewidth
Liouville
liquefy
liquidus
liter
lobewidth
lock-in
Lorentz (H.A.)
Lorenz (L.)
loudspeaker
Löwdin
Lyapunov (or Liapunov)

Mach
Madelung
magnetoelastic
mainframe
mainlobe
Majorana
majorization
majorize
makeup
manageable
Markov(ian)
martensitic
matrices
Matthiessen
Maxwell(ian)
mean life
measurable
mechanician
meltdown
metastable
Metropolis
microwave
midgap
midplane
midpoint
mixmaster
Möbius
modeling
moiré
molal
molar
monatomic
monochromator
monotonic
Mössbauer
Mossotti
movable

Néel
Newtonian
nilpotent
nonelastic
non-negative
noticeable
Nozières
nutational
Nyquist

occurrence
occurring
off-diagonal
off-resonance
ordinate
organometallic
Ornstein-Zernike
orthorhombic
ortho state
outflowing
outgassing
output
out-state
overall
overstability

Padé
pairwise
parallelepiped
parametrize
para state
parton
passband
path length
peak width
Peccei
Peierls
percent
perihelion
perimeter
permittivity
perovskite
per se
Petri (dish)
Pfaffian
Pfirsch-Schlüter
phosphoric (adj.)
phosphorous (adj.)
phosphorus (noun)
photobleachable
photocell
photochromic
photoeffect
photoinduced
photoionization
pickoff
pickup
piezoelectric
pileup
pionization
pipet
Pitot (tube)
Planck(ian)
Poincaré
Poiseuille
polariton
polaron
polonium
poly*U*
Pomeranchuk (man)
Pomeranchukon (or Pomeron) (particle)
postignition
Poynting
preamplifier
preceding
predominant
preionized
pre-scission
principal (chief)
principle (rule)
printout
procedure
proceeding
programed
pseudoeigenfunction
pseudoscalar
pulse width
Pythagorean

quadrupole
quasielastic
quasielectron

radioactive
radiocarbon
radio frequency
radiosolution
readout
recurrence
redshift
reevaluate
reexamine
referred
reflectance
Reggeize
Reggeon
reinforced
relevant
remanent
resistivity
reststrahl(ung)(en)
résumé
rewrite
rhodamine-B
Riemann(ian)
rigorous
ripplon
rise time
rocksalt
rovibrational

sagitta
scale length
Schenectady
schizon
schlieren
Schottky
Schrödinger
Schubweg
Schwarz (inequality)
Scyllac
sealoff
Segrè
self-energy
semiaxis
semiempirical
semi-infinite
semimicro (balance)
serrometer
setup
Shockley-Read
Shubnikov
[*sic*]
sidearm
sideband
sidebranching
sidelobe
sidewall
Sierpínski
sine-Gordon
sinusoidal
sizable
Skyrmion
slepton
slit width
smectic
solenoid
Soller (slit)
spatial
spatiotemporal
spherocylindrical
spinel
squark
stationary (fixed)
stellarator
step-up
stereoisomer
stepwise
Stieltjes
stochastic
stoichiometric
Stokes
stop band
streamline
subband
sulfur
supersede
tachyon
takeoff
thermostated
Théorique (byline)
Thomson (scattering)
't Hooft
threshold
thyratron
time scale
time slice
time step
tokamak
tone burst
toward(s)
transit time
transmittance
transversity
traveling
triality
tunneling
twofold

ultrahigh
ultraviolet
umklapp
unbalance (vb.)
underdense
under way
ungerade
un-ionized
Università (It.) (byline)
Universität (Ger.) (byline)
Université (Fr.) (byline)
up-spin
uptake
usable

vacuum
van Alphen
Van de Graaff
van der Waals
Van Hove
van't Hoff
Van Vleck
varactor
vertices
vice versa
vierbein
viewpoint
viscous
von Kármán
vortices

wave breaking
wave field
wave form
wave front
wave function
waveguide
waveheight
wavelength
wave number
wave packet
wave speed
wave train
wave vector
wholly
wideband
wind tunnel
W-ino
Woods-Saxon
work function
world line
wraparound
Wronskian
wurtzite

x ray

zeros
zeroth
zinc blende
Z-ino
Zintl
Zitterbewegung

APPENDIX C: UNITS OF MEASURE

Units marked with asterisks are base, derived, or supplementary units of the *Système International.*

Unit	Abbreviation	Unit	Abbreviation
abampere	spell out	day	d, or spell out
abohm	spell out	debye	D
abvolt	spell out	decibel	dB, dBm
amagat	spell out	degree	°, deg
*ampere	A	degrees Baumé	°B
ampere hour	A h	degrees Celsius (centigrade)	°C
ampere turns per meter	At/m	degrees Fahrenheit	°F
angstrom	Å	degrees Kelvin	K
arc minute	arc min	disintegrations per minute	dis/min
astronomical unit	AU	disintegrations per minute per microgram	dis/min μg
atmosphere	atm	disintegrations per second	dis/s
atmosphere, standard	A_s	dyne	dyn
atomic mass unit	u		
atomic parts per million	at. ppm		
atomic percent	at. %		
atomic time unit	atu		
atomic unit	a.u.	electromagnetic unit	emu
attofarad	aF	electron barn	e b
		electrons per atom	e/at.
		electrons per cubic centimeter	e/cm^3, e/cc, e cm^{-3}
		electron unit	e.u.
bar	spell out	electron volt	eV
bark	spell out	electrostatic unit	esu
barn	b	entropy unit	eu
barye	spell out	erg	spell out
biot	Bi		
bit or bits	spell out		
blobs per hundred microns	blobs/(100 μm)	*farad	F
		femtofarad	fF
bohr	spell out	femtometer	fm
British thermal unit	Btu	fermi	F
bytes	spell out	fissions per minute	fpm
		foot	ft
		foot-candle	fc
		foot-lambert	fL
		foot-pound	ft lb
calorie	cal	formula units	f.u.
*candela	cd	franklin	Fr
candelas per square meter	cd/m^2		
candlepower	cp	gal	Gal (unit of gravitational force)
centimeter	cm		
centipoise	cP	gallon	gal
centistoke	cS	gauss	G
*coulomb	C	gibbs	spell out
counts per minute	counts/min, cpm	gigacycles per second	Gc/s
counts per second	counts/s	giga-electron-volt	GeV
cubic centimeter	cm^3 (cc not recommended)	gigahertz	GHz
curie	Ci	gigavolt	GV
cycle	spell out, c	gilbert	Gi
cycles per second	cps, c/s	gram	g

Unit	Abbreviation
hartree	spell out
hectogram	hg
*henry	H
*hertz	Hz
horsepower	hp
hour	h
inch	in.
*joule	J
kayser	K
*kelvin	K
kilobar	kbar
kilobyte	kbyte
kilocalorie	kcal
kilocycles per second	kc/s
kilodegrees Kelvin	kK
kilodyne	kdyn
kilo-electron-volt	keV
kilogauss	kG
*kilogram	kg
kilogram force	kgf
kilogram meter	kg m
kilohertz	kHz
kilohm	kΩ
kilojoule	kJ
kilomegacycles per second	kMc/s
kilometer	km
kilo-oersted	kOe
kiloparsec	kpc
kilosecond	ks, ksec
kiloton	kt
kilovolt	kV
kilovolt ampere	kV A
kilowatt	kW
kilowatt hour	kW h
knot	kn
lambert	L
langmuir	L
liter	l, L
Lorentz unit	LU
*lumen	lm
lumens per watt	lm/W
*lux	lx
Mach	M
maxwell	Mx
megahertz	MHz
megacycles per second	Mc/s
mega-electron-volt	MeV
megarad	Mrad
megavolt	MV
megawatt	MW
megohm	MΩ
meter	m
meter-kilogram-second ampere	mksa
meter-kilogram-second coulomb	mksc
meter of water equivalent	mwe, m (w.e.)
mho	ohm^{-1}
microampere	μA
microampere hour	μA h
microcoulomb	μC
microfarad	μF
microhm	μΩ
micrometer	μm
micromole	μmol
micron	μm
microns of mercury	μm Hg
microsecond	μs, μsec
microunit	μu
mil	spell out
mile	spell out
milliampere	mA
millibarn	mb
millicurie	mCi
millidegrees Kelvin	mK
milligram	mg
millihenry	mH
milliliter	ml
millimeter	mm
millimeters of mercury	mm Hg
millimicron	mμm
million electron volt	MeV
million volt	MV
milliunit	mu
millivolt	mV
minute	(i) min (ii)′
molal (concentration)	m
molar (concentration)	M
*mole	mol or spell out
mole percent	mol %, mole %
mole percent metal	MPM
month	spell out
nanobarn	nb
nanometer	nm

Unit	Abbreviation	Unit	Abbreviation
nanosecond	ns, nsec	revolutions per minute	rpm
nanoseconds per meter	ns/m	revolutions per second	rev/s, rps
neper	Np	roentgen	R
neutrons per fission	n/*f*	rydberg	Ry
neutrons per second	n/s		
neutrons per second per square centimeter	n/s cm^2		
		*second	(i) s, sec
*newton	N		(ii) ″
normal (concentration)	N	shake	spell out
		*siemens	S
		standard cubic centimeter per minute	sccm
oersted	Oe	statampere	spell out
*ohm	Ω	statohm	spell out
ohm centimeter	Ω cm	statvolt	spell out
ohm centimeter per centimeter per cubic centimeter	Ω cm/(cm/cm^3)	*steradian	sr
		stoke	S
ounce	oz		
		tera-electron-volt	TeV
		tetrahertz	THz
		*tesla	T
parsec	pc	ton	spell out
parts per billion	ppb	torr	Torr, torr
parts per million	ppm	townsend	Td
*pascal	Pa		
picofarad	pF		
poise	P	unified atomic mass unit	u
pound	lb		
pound-force per square inch	lb/$in.^2$		
		*volt	V
pounds per square inch	psi	volume percent	vol %
pounds per square inch absolute	psi (absolute)		
		*watt	W
pounds per square inch gauge	psi (gauge)	*weber	Wb
		webers per square meter	Wb/m^2
		week	spell out
		weight percent	wt%
rad	spell out	Weisskopf unit	W.u.
*radian	rad		
radiation length	r.l.		
reciprocal ohm	mho	year	yr

APPENDIX D: STANDARD ABBREVIATIONS

The following abbreviations (and acronyms) may be used without explanation. Any other should be defined when first introduced in manuscript.

alternating-current	ac	electromotive force	emf
altitude	alt	electron paramagnetic resonance	EPR
anno Domini	A.D.	electron spin resonance	ESR
ante meridiem	a.m.	equation	Eq.
antilogarithm	antilog	equations	Eqs.
aperture ratio 16	$f/16$	error function	erf
approximate (in subscript)	approx	error function (complement of)	erfc
arccosecant	arccsc	estimated standard deviation	e.s.d.
arccosine	arccos	*et alii* (and others)	*et al.*
arccotangent	arccot	*exempli gratia* (for example)	e.g.
arcsecant	arcsec	experiment(al) (in subscript)	expt
arcsine	arcsin	exponential	*e*,exp
arctangent	arctan		
argument	arg	face-centered-cubic	fcc
audio-frequency	af	figure	Fig.
average (in subscript)	av	figures	Figs.
		frequency-modulation	FM
Bardeen-Cooper-Schrieffer	BCS		
body-centered-cubic	bcc	gradient	grad
boiling point	bp	gram-atom	g-at.
Boltzmann's constant	k,k_B	gram-atomic-weight	g.at. wt
calculated (in subscript)	calc	Hermitian conjugate	H.c.
center of mass	c.m.	hexagonal-close-packed	hcp
centimeter-gram-second (system)	cgs	high-frequency	hf
chapter	Chap.	hyperbolic cosecant	csch
chemically pure	cp	hyperbolic cosine	cosh
coefficient (in subscript)	coeff	hyperbolic cotangent	coth
cologarithm	colog	hyperbolic secant	sech
Company	Co.	hyperbolic sine	sinh
complex conjugate	c.c.	hyperbolic tangent	tanh
confer (compare)	cf.	hyperfine structure	hfs
confidence limits	C.L.		
constant	const	*ibidem* (in the same place)	*ibid.*
contact potential difference	cpd	*id est* (that is)	i.e.
continuous-wave	cw	imaginary part	Im
Corporation	Corp.	Incorporated	Inc.
cosecant	csc	inelastic (in subscript)	inel
cosine	cos	infrared	ir
cotangent	cot	inside diameter	i.d.
cubic	cu	intermediate frequency	if
curl	$\nabla\mathbf{x}$	International Critical Tables	ICT
deoxyribose nucleic acid	DNA	laboratory (in subscript)	lab
determinant	det	latitude	lat
deviation	dev	limit	lim
diameter	diam	linear combination of atomic orbitals	LCAO
direct-current	dc	logarithm	log
District of Columbia	D.C.	logarithm (natural, base *e*)	ln
divergence	div	longitudinal-acoustic	LA
		longitudinal-optic	LO
east	E		
edition	ed.	magnetomotive force	mmf
elastic (in subscript)	el	maximum	max

melting point	mp	secant	sec
meter-kilogram-second (system)	mks	section	Sec.
minimum	min	sections	Secs.
molecular orbital	MO	Series	Ser.
		signum function	sgn
north	N	sine	sin
nota bene (mark well)	N.B.	south	S
not determined	N.D.	square	sq
nuclear magnetic resonance	NMR	standard temperature and pressure	STP
number	No.	Supplement	Suppl.
		Système International	SI
observed (in subscript)	obs		
of order less than	$o(\ )$		
of the order of	$O(\ )$	tangent	tan
outside diameter	o.d.	theory, theoretical (in subscript)	theor
		total (in subscript)	tot
page	p.	trace	tr, Tr
pages	pp.	transverse-acoustic	TA
Part	Pt.	transverse-electric	TE
post meridiem	p.m.	transverse-electromagnetic	TEM
potential difference	PD	transverse-magnetic	TM
probable error	pe	transverse-optic	TO
quantum chromodynamics	QCD		
quantum electrodynamics	QED	ultrahigh-frequency	uhf
quod erat demonstrandum (which was to be demonstrated)	Q.E.D.	ultraviolet	uv
radio-frequency	rf	valence band	VB
random-phase approximation	RPA	versus	vs
real part	Re	*videlicet* (that is to say, namely)	viz.
reference	Ref.	Volume	Vol.
references	Refs.		
ribonucleic acid	RNA		
room temperature	RT	Wentzel-Kramers-Brillouin	WKB
root-mean-square	rms	west	W

APPENDIX E: ALPHABETS AVAILABLE FOR TYPESETTING

The latin and greek alphabets shown here are in standard form. For letters in special forms see Appendix F.

Alphabet	Font	Examples (lightface and boldface)
latin	roman	a b c d e f g h i j k l m n o p q r s t u v w x y z A B C D E F G H I J K L M N O P Q R S T U V W X Y Z **a b c d e f g h i j k l m n o p q r s t u v w x y z** **A B C D E F G H I J K L M N O P Q R S T U V W X Y Z**
	italic	*a b c d e f g h i j k l m n o p q r s t u v w x y z* *A B C D E F G H I J K L M N O P Q R S T U V W X Y Z* ***a b c d e f g h i j k l m n o p q r s t u v w x y z*** ***A B C D E F G H I J K L M N O P Q R S T U V W X Y Z***
	script	𝒶 𝒷 𝒸 𝒹 ℯ 𝒻 𝑔 𝒽 𝒾 𝒿 𝓀 𝓁 𝓂 𝓃 ℴ 𝓅 𝓆 𝓇 𝓈 𝓉 𝓊 𝓋 𝓌 𝓍 𝓎 𝓏 𝒜 ℬ 𝒞 𝒟 ℰ ℱ 𝒢 ℋ ℐ 𝒥 𝒦 ℒ ℳ 𝒩 𝒪 𝒫 𝒬 ℛ 𝒮 𝒯 𝒰 𝒱 𝒲 𝒳 𝒴 𝒵 𝒂 𝒃 𝒄 𝒅 𝒆 𝒇 𝒈 𝒉 𝒊 𝒋 𝒌 𝒍 𝒎 𝒏 𝒐 𝒑 𝒒 𝒓 𝒔 𝒕 𝒖 𝒗 𝒘 𝒙 𝒚 𝒛 𝓐 𝓑 𝓒 𝓓 𝓔 𝓕 𝓖 𝓗 𝓘 𝓙 𝓚 𝓛 𝓜 𝓝 𝓞 𝓟 𝓠 𝓡 𝓢 𝓣 𝓤 𝓥 𝓦 𝓧 𝓨 𝓩
	german	𝔞 𝔟 𝔠 𝔡 𝔢 𝔣 𝔤 𝔥 𝔦 𝔧 𝔨 𝔩 𝔪 𝔫 𝔬 𝔭 𝔮 𝔯 𝔰 𝔱 𝔲 𝔳 𝔴 𝔵 𝔶 𝔷 𝔄 𝔅 ℭ 𝔇 𝔈 𝔉 𝔊 ℌ ℑ 𝔍 𝔎 𝔏 𝔐 𝔑 𝔒 𝔓 𝔔 ℜ 𝔖 𝔗 𝔘 𝔙 𝔚 𝔛 𝔜 ℨ **𝔞 𝔟 𝔠 𝔡 𝔢 𝔣 𝔤 𝔥 𝔦 𝔧 𝔨 𝔩 𝔪 𝔫 𝔬 𝔭 𝔮 𝔯 𝔰 𝔱 𝔲 𝔳 𝔴 𝔵 𝔶 𝔷** **𝔄 𝔅 ℭ 𝔇 𝔈 𝔉 𝔊 ℌ ℑ 𝔍 𝔎 𝔏 𝔐 𝔑 𝔒 𝔓 𝔔 ℜ 𝔖 𝔗 𝔘 𝔙 𝔚 𝔛 𝔜 ℨ**
	sans serif	a b c d e f g h i j k l m n o p q r s t u v w x y z A B C D E F G H I J K L M N O P Q R S T U V W X Y Z **a b c d e f g h i j k l m n o p q r s t u v w x y z** **A B C D E F G H I J K L M N O P Q R S T U V W X Y Z**
greek		*α β γ δ ϵ ζ η θ ι κ λ μ ν ξ ο π ρ σ τ ν ϕ χ ψ ω* *Γ Δ Θ Λ Ξ Π Σ Υ Φ Ψ Ω* **α β γ δ ϵ ζ η θ ι κ λ μ ν ξ ο π ρ σ τ ν ϕ χ ψ ω** **Γ Δ Θ Λ Ξ Π Σ Υ Φ Ψ Ω**

APPENDIX F: SPECIAL SYMBOLS AVAILABLE FOR TYPESETTING

The following list includes most of the special symbols that are used with some frequency. Symbols other than these may be available, but they should be carefully identified in the manuscript. The Reference Numbers are used by the American Institute of Physics.

No.	Symbol	Name or meaning
Diacritics		
D1	$\rightarrow$	right arrow
D2	$\leftarrow$	left arrow
D3	$\leftrightarrow$	double-headed arrow
D4	$\underline{\ }$	underline
D5	$\overline{\ }$	bar
D6	$\hat{\ }$	caret; circumflex
D7	$\check{\ }$	inverted caret; hacek
D8	$\tilde{\ }$	tilde
D9	$\dot{\ }$	dot
D10	$\ddot{\ }$	double dot; umlaut; diaeresis
D11	$\star$	star
D12	*	asterisk
D13	†	dagger
D14	‡	double dagger
D15	$'$	prime
D16	$''$	double prime
D17	$'''$	triple prime
D18	$\grave{\ }$	grave accent
D19	$\acute{\ }$	acute accent
D20	¸	cedilla
D21	$\breve{\ }$	breve
D22	$\mathring{\ }$	overcircle
D23	˳	undercircle
D24	˻	dental articulation
Parentheses and brackets		
B1	(	left parenthesis
B2	)	right parenthesis
B3	$\mathbf{(}$	left bold parenthesis
B4	$\mathbf{)}$	right bold parenthesis
B5	[	left bracket
B6	]	right bracket
B7	$\mathbf{[}$	left bold bracket
B8	$\mathbf{]}$	right bold bracket
B9	{	left brace
B10	}	right brace
B11	$\mathbf{\{}$	left bold brace
B12	$\mathbf{\}}$	right bold brace
B13	⦃	left barred brace
B14	⦄	right barred brace
B15	$\vert$	vertical bar
B16	$\mathbf{\vert}$	bold vertical bar
B17	$\Vert$	double vertical bar
B18	$\mathbf{\Vert}$	bold double vertical bar
B19	$\langle$	left angular bracket; Dirac bra
B20	$\rangle$	right angular bracket; Dirac ket
B21	$\boldsymbol{\langle}$	left bold angular bracket; bold Dirac bra
B22	$\boldsymbol{\rangle}$	right bold angular bracket; bold Dirac ket
Mathematical signs of relation		
R1	=	equals; double bond
R2	$\neq$	not equal to
R3	$\triangleq$	corresponds to
R4	$\equiv$	identically equal to; equivalent to; triple bond
R5	$\not\equiv$	not identically equal to; not equivalent to; not always equal to
R6	$\sim$	asymptotically equal to; of the order of magnitude of
R7	$\approx$	approximately equal to
R8	$\approx$	approximately equal to
R9	$\cong$	congruent to; approximately equal to
R10	$\propto$	proportional to
R11	$<$	less than
R12	$>$	greater than
R13	$\not<$	not less than
R14	$\not>$	not greater than
R15	$\ll$	much less than
R16	$\gg$	much greater than
R17	$\leq$	less than or equal to
R18	$\geq$	greater than or equal to
R19	$\lesssim$	less than or approximately equal to
R20	$\gtrsim$	greater than or approximately equal to
R21	$\lessgtr$	less than or greater than
R22	$\gtrless$	greater than or less than
R23	$\subset$	included in, a subset of
R24	$\supset$	contains as a subset
R25	$\not\subset$	not included in, not a subset of
R26	$\subseteq$	contained within
R27	$\supseteq$	contains
R28	$\in$	an element of
R29	$\ni$	contains as an element
R30	$\notin$	not an element of
R31	$\rightarrow$	approaches, tends to; yields; is replaced by
R32	$\leftarrow$	transition symbol
R33	$\leftrightarrow$	mutually implies
R34	$\rightleftarrows$	right-left arrows
R35	$\leftrightarrows$	left-right arrows
R36	$\rightleftharpoons$	right-left arrows, showing predominance
R37	$\leftrightharpoons$	left-right arrows, showing predominance
R38	$\uparrow$	gives off as a gas; up; approaches from below
R39	$\downarrow$	precipitates; down; approaches from above
R40	$\nearrow$	up diagonal arrow
R41	$\searrow$	down diagonal arrow
R42	$\rightsquigarrow$	wavy arrow
R43	$\rightleftharpoons$	right-left half arrows
R44	$\leftrightharpoons$	left-right half arrows
R45	$\upharpoonleft$	left half arrow
R46	$\upharpoonright$	right half arrow
R47	$\Rightarrow$	implies; is replaced by
R48	$\Leftarrow$	is implied by
R49	$\Leftrightarrow$	if and only if
R50	$\mathbf{\rightarrow}$	bold arrow
R51	$\perp$	perpendicular (to)
R52	$\parallel$	parallel (to)
R53	::	as
Mathematical operators		
Q1	$+$	plus
Q2	$\dot{+}$	plus with dot
Q3	$\oplus$	direct sum
Q4	$\dot{+}$	semidirect sum
Q5	$-$	minus
Q6	$\pm$	plus or minus
Q7	$\mp$	minus or plus
Q8	$\times$	multiplication sign

No.	Symbol	Name or meaning
Q9	×	bold multiplication sign
Q10	⨯	multiplication sign with dot
Q11	⊗	direct product
Q12	⋉	semidirect product
Q13	·	centered dot
Q14	•	bold centered dot
Q15	∘	convolution sign
Q16	∧	wedge, roof (outer product sign; conjunction sign)
Q17	∨	inverted wedge or roof (disjunction sign)
Q18	/	slash, solidus
Q19	\	backward slash or solidus
Q20	∩	intersection sign
Q21	∪	union sign
Q22	√	radical
Q23	∫	integral
Q24	∮	contour integral
Q25	∯	double contour integral
Q26	∰	triple contour integral
Q27	∲	contour integral, anticlockwise direction
Q28	∳	contour integral, clockwise direction
Q29	∑	summation
Q30	∏	product symbol
Q31	∂	backcurling delta (partial derivative sign)
Q32	∇	del (vector operator)
Q33	∇	bold del
Q34	∀	inverted sans serif aye (for all)
Q35	∃	inverted sans serif ee (there exists)
Q36	⅂	inverted sans serif ell
Q37	ɘ	inverted lower-case epsilon (such that)

Phonetic symbols

P1	ɐ	inverted aye
P2	ɑ	open aye
P3	ɒ	inverted open aye
P4	ɕ	looped cee
P5	ə	schwa
P6	ɚ	hooked schwa
P7	ɛ	eh
P8	ɜ	backward eh
P9	ɝ	hooked backward eh
P10	ɟ	inverted eff
P11	ɥ	inverted aitch
P12	ɦ	hooked aitch
P13	ɾ	inverted small capital jay
P14	ɻ	inverted kay
P15	ɱ	hooked em
P16	ɯ	inverted em
P17	ɲ	left hooked en
P18	ŋ	right hooked en
P19	ɔ	open oh
P20	ɹ	inverted are
P21	ʁ	inverted small capital are
P22	ɻ	inverted tee
P23	ʊ	small capital you
P24	ʏ	vee with swirl
P25	ʌ	inverted vee
P26	ʍ	inverted double-you
P27	ʎ	inverted why
P28	æ	ash, ligature
P29	œ	ligature
P30	ʒ	yog
P31	ð	edh
P32	˕	low modifier
P33	˞	front modifier
P34	ˠ	high modifier
P35	ˤ	back modifier

Figure symbols

F1	△	open triangle
F2	▲	closed triangle
F3	▽	inverted open triangle
F4	▼	inverted closed triangle
F5	□	open square
F6	■	closed square
F7	◩	half-closed square (left)
F8	◪	half-closed square (right)
F9	○	open circle
F10	●	closed circle
F11	◐	half-closed circle (left)
F12	◑	half-closed circle (right)
F13	◇	open diamond
F14	◆	closed diamond
F15	⊖	barred circle
Q1	+	plus (cross)
Q3	⊕	circle with plus
Q8	×	multiplication sign (cross)
Q11	⊗	circle with multiplication sign

Miscellaneous

M1	∞	infinity
M2	∢	arc
M3	∠	angle
M4	§	section
M5	¶	paragraph
M6	∅	null set sign
M7	£	pounds
M8	$	dollars
M9	¢	cents
M10	#	mesh; sharp
M11	♭	flat
M12	♮	natural
M13	&	ampersand (and)
M14	%	percent
M15	°	degrees
M16	∴	therefore
M17	ℵ	Hebrew aleph
M18	℘	Icelandic pee
M19	ℏ	Dirac h, h-bar
M20	Å	angstrom
M21	å	Danish aye
M22	ϰ	cursive lower-case kappa
M23	φ	curly phi
M24	ϑ	curly theta
M25	ϴ	aitch (or "fancy") theta
M26	ϖ	omega with tilde
M27	@	at
M28	©	copyright
M29	®	registered
M30	⊙	sun
M31	ḍ	day
M32	ḥ	hour
M33	ṃ	minute
M34	ṣ	second

APPENDIX G: JOURNAL TITLE ABBREVIATIONS

The following is a list of journal abbreviations. For example, J. Vac. Sci. Technol. is the standard abbreviation for the *Journal of Vacuum Science and Technology*. The journals listed are those most frequently cited in physics research. A more complete list is given in *Bibliographic Guide for Editors & Authors* (American Chemical Society, Washington, D.C., 1974); for abbreviations of titles of mathematical journals, the *Guide* should be supplemented by *Abbreviations of the Names of Scientific Periodicals Reviewed in Mathematical Reviews* (American Mathematical Society, Providence, R.I., 1971). A transliterated Russian title is followed immediately by the title of the corresponding translated journal, and this combined form should be imitated when citing from the Russian literature. To simplify alphabetization, "The" as the first word of a title is omitted.

Accounts of Chemical Research	Acc. Chem. Res.
Acta Chemica Scandinavica	Acta Chem. Scand.
Acta Crystallographica	Acta Crystallogr.
Acta Crystallographica, Section A: Crystal Physics, Diffraction, Theoretical and General Crystallography	Acta Crystallogr. Sec. A
Acta Crystallographica, Section B: Structural Crystallography and Crystal Chemistry	Acta Crystallogr. Sec. B
Acta Mathematica Academiae Scientiarum Hungaricae	Acta Math. Acad. Sci. Hung.
Acta Metallurgica	Acta Metall.
Acta Oto-Laryngologica	Acta Oto-Laryngol.
Acta Physica	Acta Phys.
Acta Physica Austriaca	Acta Phys. Austriaca
Acta Physica Polonica	Acta Phys. Pol.
Acustica	Acustica
Advances in Applied Mechanics	Adv. Appl. Mech.
Advances in Atomic, Molecular, and Optical Physics	Adv. At. Mol. Opt. Phys.
Advances in Chemical Physics	Adv. Chem. Phys.
Advances in Magnetic Resonance	Adv. Magn. Reson.
Advances in Physics	Adv. Phys.
Advances in Quantum Chemistry	Adv. Quantum Chem.
AIAA Journal	AIAA J.
AIChE Journal	AIChE J.
AIP Conference Proceedings	AIP Conf. Proc.
Akusticheskii Zhurnal [Soviet Physics-Acoustics]	Akust. Zh. [Sov. Phys. Acoust.]
American Journal of Physics	Am. J. Phys.
Analytical Chemistry	Anal. Chem.
Annalen der Physik (Leipzig)	Ann. Phys. (Leipzig)
Annales de Chimie et de Physique	Ann. Chim. Phys.
Annales de Geophysique	Ann. Geophys.
Annales de l'Institut Henri Poincaré	Ann. Inst. Henri Poincaré
Annales de l'Institut Henri Poincaré, Section A: Physique Theorique	Ann. Inst. Henri Poincaré, A
Annales de l'Institut Henri Poincaré, Section B: Calcul des Probabilites et Statistique	Ann. Inst. Henri Poincaré, B
Annales de Physique (Paris)	Ann. Phys. (Paris)
Annals of Fluid Dynamics	Ann. Fluid Dyn.
Annals of Mathematics	Ann. Math.
Annals of Otology, Rhinology, & Laryngology	Ann. Otol. Rhinol. Laryngol.
Annals of Physics (New York)	Ann. Phys. (N.Y.)
Annual Review of Nuclear Science	Annu. Rev. Nucl. Sci.
Applied Optics	Appl. Opt.
Applied Physics Letters	Appl. Phys. Lett.
Applied Spectroscopy	Appl. Spectrosc.
Arkiv foer Fysik	Ark. Fys.
Astronomical Journal	Astron. J.

Astronomicheskii Zhurnal [Soviet Astronomy]	Astron. Zh. [Sov. Astron.]
Astronomische Nachrichten	Astron. Nachr.
Astronomy and Astrophysics	Astron. Astrophys.
Astrophysical Journal	Astrophys. J.
Astrophysical Journal, Letters to the Editor	Astrophys. J. Lett.
Astrophysical Journal, Supplement Series	Astrophys. J. Suppl. Ser.
Astrophysical Letters	Astrophys. Lett.
Atomnaya Energiya [Soviet Journal of Atomic Energy]	At. Energ. [Sov. J. At. Energy]
Australian Journal of Physics	Aust. J. Phys.
Bell System Technical Journal	Bell Syst. Tech. J.
Berichte der Bunsengesellschaft für Physikalische Chemie	Ber. Bunsenges. Phys. Chem.
British Journal of Applied Physics	Br. J. Appl. Phys.
Bulletin of the Academy of Sciences of the USSR, Physical Series (translation of Izvestiya Akademii Nauk SSSR, Seriya Fizicheskaya)	Bull. Acad. Sci. USSR, Phys. Ser.
Bulletin of the American Astronomical Society	Bull. Am. Astron. Soc.
Bulletin of The American Physical Society	Bull. Am. Phys. Soc.
Bulletin of the Astronomical Institutes of the Netherlands	Bull. Astron. Instit. Neth.
Bulletin of the Chemical Society of Japan	Bull. Chem. Soc. Jpn.
Bulletin of the Seismological Society of America	Bull. Seismol. Soc. Am.
Canadian Journal of Chemistry	Can. J. Chem.
Canadian Journal of Physics	Can. J. Phys.
Canadian Journal of Research	Can. J. Res.
Chemical Physics	Chem. Phys.
Chemical Physics Letters	Chem. Phys. Lett.
Chemical Reviews	Chem. Rev.
Classical and Quantum Gravity	Class. Quantum Grav.
Comments on Nuclear and Particle Physics	Comments Nucl. Part. Phys.
Communications in Mathematical Physics	Commun. Math. Phys.
Communications on Pure and Applied Mathematics	Commun. Pure Appl. Math.
Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences	C. R. Acad. Sci.
Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences, Serie A: Sciences Mathematiques	C. R. Acad. Ser. A
Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences, Serie B: Sciences Physiques	C. R. Acad. Ser. B
Computers in Physics	Comput. Phys.
Cryogenics	Cryogenics
Czechoslovak Journal of Physics	Czech. J. Phys.
Discussions of the Faraday Society	Discuss. Faraday Soc.
Doklady Akademii Nauk SSSR [Soviet Physics Doklady]	Dok. Akad. Nauk SSSR [Sov. Phys. Dokl.]
Earth and Planetary Science Letters	Earth Planet. Sci. Lett.
Electronics Letters	Electron. Lett.
Experientia	Experientia
Fields and Quanta	Fields Quanta
Fizika Elementarnykh Chastits i Atomnogo Yadra [Soviet Journal of Particles and Nuclei]	Fiz. Elem. Chastits At. Yadra [Sov. J. Part. Nucl.]
Fizika i Tekhnika Poluprovodnikov [Soviet Physics Semiconductors]	Fiz. Tekh. Poluprovodn. [Sov. Phys. Semicond.]

Fizika Metallov i Metallovedenie [Physics of Metals and Metallography (USSR)]	Fiz. Met. Metalloved. [Phys. Met. Metallogr. (USSR)]
Fizika Nizkikh Temperatur [Soviet Journal of Low Temperature Physics]	Fiz. Nizk. Temp. [Sov. J. Low Temp. Phys.]
Fizika Plazmy [Soviet Journal of Plasma Physics]	Fiz. Plazmy [Sov. J. Plasma Phys.]
Fizika Tverdogo Tela (Leningrad) [Soviet Physics-Solid State]	Fiz. Tverd. Tela (Leningrad) [Sov. Phys. Solid State]
Fizika (Zagreb)	Fizika (Zagreb)
Fortschritte der Physik	Fortschr. Phys.
Foundations of Physics	Found. Phys.
General Relativity and Gravitation	Gen. Relativ. Gravit.
Geochimica et Cosmochimica Acta	Geochim. Cosmochim. Acta
Geophysical Research Letters	Geophys. Res. Lett.
Handbuch der Physik	Handb. Phys.
Helvetica Chimica Acta	Helv. Chim. Acta
Helvetica Physica Acta	Helv. Phys. Acta
High Temperature (USSR) (translation of Teplofizika Vysokikh Temperatur)	High Temp. (USSR)
IBM Journal of Research and Development	IBM J. Res. Dev.
Icarus. International Journal of the Solar System	Icarus.
IEEE Journal of Quantum Electronics	IEEE J. Quantum Electron.
IEEE Transactions on Antennas and Propagation	IEEE Trans. Antennas Propag.
IEEE Transactions on Electron Devices	IEEE Trans. Electron Devices
IEEE Transactions on Information Theory	IEEE Trans. Inf. Theory
IEEE Transactions on Instrumentation and Measurement	IEEE Trans. Instrum. Meas.
IEEE Transactions on Magnetics	IEEE Trans. Magn.
IEEE Transactions on Microwave Theory and Techniques	IEEE Trans. Microwave Theory Tech.
IEEE Transactions on Nuclear Science	IEEE Trans. Nucl. Sci.
IEEE Transactions on Sonics Ultrasonics	IEEE Trans. Sonics Ultrason.
Industrial and Engineering Chemistry	Ind. Eng. Chem.
Infrared Physics	Infrared Phys.
Inorganic Chemistry	Inorg. Chem.
Inorganic Materials (USSR) (translation of Izvestiya Akademii Nauk SSSR, Neorganicheskie Materialy)	Inorg. Mater. (USSR)
Instruments and Experimental Techniques (USSR) (translation of Pribory i Tekhnika Eksperimenta)	Instrum. Exp. Tech. (USSR)
International Journal of Magnetism	Int. J. Magn.
International Journal of Quantum Chemistry	Int. J. Quantum Chem.
International Journal of Quantum Chemistry, Part 1	Int. J. Quantum Chem. 1
International Journal of Quantum Chemistry, Part 2	Int. J. Quantum Chem. 2
International Journal of Theoretical Physics	Int. J. Theor. Phys.
Izvestiya, Academy of Sciences, USSR, Atmospheric and Oceanic Physics (translation of Izvestiya Akademii Nauk SSSR, Fizika Atmosfery i Okeana)	Izv. Acad. Sci. USSR, Atmos. Oceanic Phys.
Izvestiya, Academy of Sciences, USSR, Physics of the Solid Earth (translation of Izvestiya Akademii Nauk SSSR, Fizika Zemli)	Izv. Acad. Sci. USSR, Phys. Solid Earth
Izvestiya Akademii Nauk SSSR, Fizika Atmosfery i Okeana [Izvestiya, Academy of Sciences, USSR, Atmospheric and Oceanic Physics]	Izv. Akad. Nauk SSSR, Fiz. Atmos. Okeana [Izv. Acad. Sci. USSR, Atmos. Oceanic Phys.]

Izvestiya Akademii Nauk SSSR, Fizika Zemli [Izvestiya, Academy of Sciences, USSR, Physics of the Solid Earth]	Izv. Akad. Nauk SSSR, Fiz. Zemli [Izv. Acad. Sci. USSR, Phys. Solid Earth]
Izvestiya Akademii Nauk SSSR, Neorganicheskie Materialy [Inorganic Materials (USSR)]	Izv. Akad. Nauk SSSR, Neorg. Mater. [Inorg. Mater. (USSR)]
Izvestiya Akademii Nauk SSSR, Seriya Fizicheskaya [Bulletin of the Academy of Sciences of the USSR, Physical Series]	Izv. Akad. Nauk SSSR, Ser. Fiz. [Bull. Acad. Sci. USSR, Phys. Ser.]
Izvestiya Vysshikh Uchebnykh Zavedenii, Fizika [Soviet Physics Journal]	Izv. Vyssh. Uchebn. Zaved. Fiz. [Sov. Phys. J.]
Izvestiya Vysshikh Uchebnykh Zavedenni, Radiofizika [Soviet Radiophysics]	Izv. Vyssh. Uchebn. Zaved. Radiofiz. [Sov. Radiophys.]
Japanese Journal of Applied Physics	Jpn. J. Appl. Phys.
Japanese Journal of Physics	Jpn. J. Phys.
JETP Letters (translation of Pis'ma v Zkurnal Eksperimental'noi i Teoreticheskoi Fiziki)	JETP Lett.
Journal de Chimie Physique	J. Chim. Phys.
Journal de Physique (Paris)	J. Phys. (Paris)
Journal de Physique et le Radium	J. Phys. Radium
Journal of Applied Crystallography	J. Appl. Crystallogr.
Journal of Applied Physics	J. Appl. Phys.
Journal of Applied Spectroscopy (USSR) (translation of Zhurnal Prikladnoi Spektroskopii)	J. Appl. Spectrosc. (USSR)
Journal of Atmospheric and Terrestrial Physics	J. Atmos. Terr. Phys.
Journal of Atmospheric Sciences	J. Atmos. Sci.
Journal of Chemical Physics	J. Chem. Phys.
Journal of Computational Physics	J. Comput. Phys.
Journal of Crystal Growth	J. Cryst. Growth
Journal of Fluid Mechanics	J. Fluid Mech.
Journal of Geophysical Research	J. Geophys. Res.
Journal of Inorganic and Nuclear Chemistry	J. Inorg. Nucl. Chem.
Journal of Lightwave Technology	J. Lightwave Technol.
Journal of Low Temperature Physics	J. Low Temp. Phys.
Journal of Luminescence	J. Lumin.
Journal of Macromolecular Science, [Part B] Physics	J. Macromol. Sci. Phys.
Journal of Materials Research	J. Mater. Res.
Journal of Mathematical Physics (New York)	J. Math. Phys. (N.Y.)
Journal of Mathematics and Physics (Cambridge, Mass.)	J. Math. Phys. (Cambridge, Mass.)
Journal of Molecular Spectroscopy	J. Mol. Spectrosc.
Journal of Non-Crystalline Solids	J. Non-Cryst. Solids
Journal of Nuclear Energy	J. Nucl. Energy
Journal of Nuclear Energy, Part C: Plasma Physics, Accelerators, Thermonuclear Research	J. Nucl. Energy, Part C
Journal of Nuclear Materials	J. Nucl. Mater.
Journal of Physical and Chemical Reference Data	J. Phys. Chem. Ref. Data
Journal of Physical Chemistry	J. Phys. Chem.
Journal of Physics A: Mathematical and General	J. Phys. A
Journal of Physics and Chemistry of Solids	J. Phys. Chem. Solids
Journal of Physics B: Atomic, Molecular and Optical Physics	J. Phys. B
Journal of Physics C: Solid State Physics	J. Phys. C
Journal of Physics D: Applied Physics	J. Phys. D
Journal of Physics E: Scientific Instruments	J. Phys. E
Journal of Physics F: Metal Physics	J. Phys. F
Journal of Physics G: Nuclear and Particle Physics	J. Phys. G

Journal of Physics (Moscow)	J. Phys. (Moscow)
Journal of Plasma Physics	J. Plasma Phys.
Journal of Polymer Science	J. Polym. Sci.
Journal of Polymer Science, Polymer Letters Edition	J. Polym. Sci., Polym. Lett. Ed.
Journal of Polymer Science, Polymer Physics Edition	J. Polym. Sci., Polym. Phys. Ed.
Journal of Quantitative Spectroscopy & Radiative Transfer	J. Quant. Spectros. Radiat. Transfer
Journal of Research of the National Bureau of Standards	J. Res. Natl. Bur. Stand.
Journal of Research of the National Bureau of Standards, Section A: Physics and Chemistry	J. Res. Natl. Bur. Stand. Sec. A
Journal of Research of the National Bureau of Standards, Section B: Mathematical Sciences	J. Res. Natl. Bur. Stand. Sec. B
Journal of Research of the National Bureau of Standards, Section C: Engineering and Instrumentation	J. Res. Natl. Bur. Stand. Sec. C
Journal of Rheology	J. Rheol.
Journal of Sound and Vibration	J. Sound Vib.
Journal of Speech and Hearing Disorders	J. Speech Hear. Disord.
Journal of Speech and Hearing Research	J. Speech Hear. Res.
Journal of Statistical Physics	J. Stat. Phys.
Journal of the Acoustical Society of America	J. Acous. Soc. Am.
Journal of the American Ceramic Society	J. Am. Ceram. Soc.
Journal of the American Chemical Society	J. Am. Chem. Soc.
Journal of the American Institute of Electrical Engineers	J. Am. Inst. Electr. Eng.
Journal of the Audio Engineering Society	J. Audio Engin. Soc.
Journal of the Chemical Society	J. Chem. Soc.
Journal of the Electrochemical Society	J. Electrochem. Soc.
Journal of the Mechanics and Physics of Solids	J. Mech. Phys. Solids
Journal of the Optical Society of America	J. Opt. Soc. Am.
Journal of the Optical Society of America A	J. Opt. Soc. Am. A
Journal of the Optical Society of America B	J. Opt. Soc. Am. B
Journal of the Physical Society of Japan	J. Phys. Soc. Jpn.
Journal of Vacuum Science and Technology	J. Vac. Sci. Technol.
Journal of Vacuum Science and Technology A	J. Vac. Sci. Technol. A
Journal of Vacuum Science and Technology B	J. Vac. Sci. Technol. B
Kolloid Zeitschrift & Zeitschrift für Polymere	Kolloid Z. Z. Polym.
Kongelige Danske Videnskabernes Selskab, Matematsik-Fysiske Meddelelser	K. Dan. Vidensk. Selsk. Mat. Fys. Medd.
Kristallografiya [Soviet Physics-Crystallography]	Kristallografiya [Sov. Phys. Crystallogr.]
Kvantovaya Elektronika (Moscow) [Soviet Journal of Quantum Electronics]	Kvant. Elektron. (Moscow) [Sov. J. Quantum Electron.]
Laryngoscope	Laryngoscope
Lettere al Nuovo Cimento	Lett. Nuovo Cimento
Lick Observatory Bulletins	Lick Obs. Bull.
Materials Research Bulletin	Mater. Res. Bull.
Medical Physics	Med. Phys.
Memoirs of the Royal Astronomical Society	Mem. R. Astron. Soc.
Molecular Crystals and Liquid Crystals	Mol. Cryst. Liq. Cryst.
Molecular Physics	Mol. Phys.
Monthly Notices of the Royal Astronomical Society	Mon. Not. R. Astron. Soc.
National Bureau of Standards (U.S.), Circular	Natl. Bur. Stand. (U.S.), Circ.
National Bureau of Standards (U.S.), Miscellaneous Publication	Natl. Bur. Stand. (U.S.), Misc. Publ.
National Bureau of Standards (U.S.), Special Publication	Natl Bur. Stand. (U.S.), Spec. Publ.

Nature (London)	Nature (London)
Naturwissenschaften	Naturwissenschaften
Nonlinearity	Nonlinearity
Nuclear Data, Section A	Nucl. Data, Sect. A
Nuclear Fusion	Nucl. Fusion
Nuclear Instruments	Nucl. Instrum.
Nuclear Instruments & Methods	Nucl. Instrum. Methods
Nuclear Physics	Nucl. Phys.
Nuclear Physics A	Nucl. Phys. A
Nuclear Physics B	Nucl. Phys. B
Nuclear Science and Engineering	Nucl. Sci. Eng.
Nukleonik	Nukleonik
Nuovo Cimento	Nuovo Cimento
Nuovo Cimento A	Nuovo Cimento A
Nuovo Cimento B	Nuovo Cimento B
Optica Acta	Opt. Acta
Optics and Spectroscopy (USSR) (translation of Optika i Spektroskopiya)	Opt. Spectrosc. (USSR)
Optics Communications	Opt. Commun.
Optics Letters	Opt. Lett.
Optics News	Opt. News
Optik (Stuttgart)	Optik (Stuttgart)
Optika i Spektroskopiya [Optics and Spectroscopy (USSR)]	Opt. Spektrosk. [Opt. Spectrosc. (USSR)]
Optiko-Mekhanicheskaya Promyshlennost [Soviet Journal of Optical Technology]	Opt. Mekh. Prom. [Sov. J. Opt. Technol.]
Perception and Psychophysics	Percept. Psychophys.
Philips Research Reports	Philips Res. Rep.
Philosophical Magazine	Philos. Mag.
Philosophical Transactions of the Royal Society of London	Philos. Trans. R. Soc. London
Philosophical Transactions of the Royal Society of London, Series A: Mathematical and Physical Sciences	Philos. Trans. R. Soc. London, Ser. A
Physical Review	Phys. Rev.
Physical Review A	Phys. Rev. A
Physical Review B: Condensed Matter	Phys. Rev. B
Physical Review C: Nuclear Physics	Phys. Rev. C
Physical Review D: Particles and Fields	Phys. Rev. D
Physical Review Letters	Phys. Rev. Lett.
Physica Status Solidi	Phys. Status Solidi
Physica Status Solidi A: Applied Research	Phys. Status Solidi A
Physica Status Solidi B: Basic Research	Phys. Status Solidi B
Physica (Utrecht)	Physica (Utrecht)
Physics and Chemistry of Solids	Physics and Chemistry of Solids
Physics Letters	Phys. Lett.
Physics Letters A	Phys. Lett. A
Physics Letters B	Phys. Lett. B
Physics (New York)	Phys. (N.Y.)
Physics of Fluids	Phys. Fluids
Physics of Fluids A	Phys. Fluids A
Physics of Fluids B	Phys. Fluids B
Physics of Metals and Metallography (USSR) (translation of Fizika Metallov i Metallovedenie)	Phys. of Metals and Metallography (USSR)
Physics Teacher	Phys. Teach.
Physics Today	Phys. Today

Physikalische Zeitschrift	Phys. Z.
Physikalische Zeitschrift der Sowjetunion	Phys. Z. Sowjetunion
Physik der Kondensierten Materie	Phys. Konden. Mater.
Pis'ma v Astronomicheskii Zhurnal [Soviet Astronomy Letters]	Pis'ma Astron. Zh. [Sov. Astron. Lett.]
Pis'ma v Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki [JETP Letters]	Pis'ma Zh. Eksp. Teor. Fiz. [JETP Letters]
Pis'ma v Zhurnal Tekhnicheskoi Fiziki [Soviet Technical Physics Letters]	Pis'ma Zh. Tekh. Fiz. [Sov. Tech. Phys. Lett.]
Planetary and Space Science	Planet. Space Sci.
Plasma Physics	Plasma Phys.
Pribory i Tekhnika Eksperimenta [Instruments and Experimental Techniques (USSR)]	Prib. Tekh. Eksp. [Instrum. Exp. Tech. (USSR)]
Proceedings of the Cambridge Philosophical Society	Proc. Cambridge Philos. Soc.
Proceedings of the IEEE	Proc. IEEE
Proceedings of the IRE	Proc. IRE
Proceedings of the National Academy of Sciences of the United States of America	Proc. Natl. Acad. Sci. U.S.A.
Proceedings of the Physical Society, London	Proc. Phys. Soc. London
Proceedings of the Physical Society, London, Section A	Proc. Phys. Soc. London, Sect. A
Proceedings of the Physical Society, London, Section B	Proc. Phys. Soc. London, Sect. B
Proceedings of the Royal Society of London	Proc. R. Soc. London
Proceedings of the Royal Society of London, Series A: Mathematical and Physical Sciences	Proc. R. Soc. London, Ser. A
Progress of Theoretical Physics	Prog. Theor. Phys.
Publications of the Astronomical Society of the Pacific	Publ. Astron. Soc. Pac.
Radiation Effects	Radiat. Eff.
Radio Engineering and Electronic Physics (USSR) (translation of Radiotekhnika i Elektronika)	Radio Eng. Electron. Phys. (USSR)
Radio Engineering and Electronics (USSR) (translation of Radiotekhnika i Elektronika)	Radio Eng. Electron. (USSR)
Radiology	Radiology
Radio Science	Radio Sci.
Radiotekhnika i Elektronika [Radio Engineering and Electronic Physics (USSR)]	Radiotekh. Elektron. [Radio Eng. Electron. Phys. (USSR)]
Radiotekhnika i Elektronika [Radio Engineering and Electronics (USSR)]	Radiotekh. Elektron. [Radio Eng. Electron. (USSR)]
RCA Review	RCA Rev.
Reports on Progress in Physics	Rep. Prog. Phys.
Review of Scientific Instruments	Rev. Sci. Instrum.
Reviews of Geophysics	Rev. Geophys.
Reviews of Modern Physics	Rev. Mod. Phys.
Revue d'Optique, Theorique et Instrumentale	Rev. Opt. Theor. Instrum.
Russian Journal of Physical Chemistry (translation of Zhurnal Fizicheskoi Khimii)	Russ. J. Phys. Chem.
Science	Science
Scientific American	Sci. Am.
Solar Physics	Sol. Phys.
Solid State Communications	Solid State Commun.
Solid State Physics	Solid State Phys.
Solid-State Electronics	Solid-State Electron.
Soviet Astronomy (translation of Astronomicheskii Zhurnal)	Sov. Astron.

Soviet Astronomy Letters (translation of Pis'ma v Astronomicheskii Zhurnal)	Sov. Astron. Lett.
Soviet Journal of Atomic Energy (translation of Atomnaya Energiya)	Sov. J. At. En.
Soviet Journal of Low Temperature Physics (translation of Fizika Nizkikh Temperatur)	Sov. J. Low Temp. Phys.
Soviet Journal of Nuclear Physics (translation of Yadernaya Fizika)	Sov. J. Nucl. Phys.
Soviet Journal of Optical Technology (translation of Optiko-Mekhanischeskaya Promyshlennost)	Sov. J. Opt. Technol.
Soviet Journal of Particles and Nuclei (translation of Fizika Elementarnykh Chastits i Atomnogo Yadra)	Sov. J. Part. Nucl.
Soviet Journal of Plasma Physics (translation of Fizika Plazmy)	Sov. J. Plasma Phys.
Soviet Journal of Quantum Electronics [translation of Kvantovaya Elektronika (Moscow)]	Sov. J. Quantum Electron.
Soviet Physics-Acoustics (translation of Akusticheskii Zhurnal)	Sov. Phys. Acoust.
Soviet Physics-Crystallography (translation of Kristallografiya)	Sov. Phys. Crystallogr.
Soviet Physics-Doklady (translation of Doklady Akademii Nauk SSSR)	Sov. Phys. Dokl.
Soviet Physics-JETP (translation of Zhurnal Eksperimental'noi i Teoretischeskoi Fiziki)	Sov. Phys. JETP
Soviet Physics Journal (translation of Izvestiya Vysshikh Uchebnykh Zavedenii, Fizika)	Sov. Phys. J.
Soviet Physics-Semiconductors (translation of Fizika i Tekhnika Poluprovodnikov)	Sov. Phys. Semicond.
Soviet Physics-Solid State [translation of Fizika Tverdogo Tela (Leningrad)]	Sov. Phys. Solid State
Soviet Physics-Technical Physics (translation of Zhurnal Tekhnicheskoi Fiziki)	Sov. Phys. Tech. Phys.
Soviet Physics-Uspekhi (translation of Uspekhi Fizicheskikh Nauk)	Sov. Phys. Usp.
Soviet Radiophysics (translation of Izvestiya Vysshikh Uchebnykh Zavedenii, Radiofizika)	Sov. Radiophys.
Soviet Technical Physics Letters (translation of Pis'ma v Zhurnal Tekhnicheskoi Fiziki)	Sov. Tech. Phys. Lett.
Spectrochimica Acta	Spectrochim. Acta
Spectrochimica Acta, Part A: Molecular Spectroscopy	Spectrochim. Acta, Part A
Spectrochimica Acta, Part B: Atomic Spectroscopy	Spectrochim. Acta, Part B
Superconductor Science and Technology	Supercon. Sci. Technol.
Surface Science	Surf. Sci.
Tectonics	Tectonics
Teplofizika Vysokikh Temperatur [High Temperature (USSR)]	Teplofiz. Vys. Temp. [High Temp.(USSR)]
Tetrahedron	Tetrahedron
Theoretica Chimica Acta	Theor. Chim. Acta

Thin Solid Films	Thin Solid Films
Transactions of the American Crystallographic Society	Trans. Am. Cryst. Soc.
Transactions of the American Geophysical Union	Trans. Am. Geophys. Union
Transactions of the American Institute of Mining, Metallurgical and Petroleum Engineers	Trans. Am. Inst. Min. Metall. Pet. Eng.
Transactions of the American Nuclear Society	Trans. Am. Nucl. Soc.
Transactions of the American Society for Metals	Trans. Am. Soc. Met.
Transactions of the American Society of Mechanical Engineers	Trans. Am. Soc. Mech. Eng.
Transactions of the British Ceramic Society	Trans. Br. Ceramic Society
Transactions of the Faraday Society	Trans. Faraday Society
Transactions of the Metallurgical Society of AIME	Trans. Metall. Soc. AIME
Transactions of the Society of Rheology	Trans. Soc. Rheol.
Ukrainian Physics Journal [translation of Ukrainskii Fizicheskii Zhurnal (Russian Edition)]	Ukr. Phys. J.
Ukrainian Fizicheskii Zhurnal (Russian Edition) [Ukrainian Physics Journal]	Ukr. Fiz. Zh. (Russ. Ed.) [Ukr. Phys. J.]
Ultrasonics	Ultrasonics
Uspekhi Fizicheskikh Nauk [Soviet Physics-Uspekhi]	Usp. Fiz. Nauk [Sov. Phys. Usp.]
Wuli Xuebao (Acta Physica Sinica) [Chinese Journal of Physics]	Wuli Xuebao (Acta Phys. Sin.) [Chin. J. Phys.]
Yadernaya Fizika [Soviet Journal of Nuclear Physics]	Yad. Fiz. [Sov. J. Nucl. Phys.]
Zeitschrift für Analytische Chemie	Z. Anal. Chem.
Zeitschrift für Angewandte Physik	Z. Angew. Phys.
Zeitschrift für Anorganische und Allgemeine Chemie	Z. Anorg. Allg. Chem.
Zeitschrift für Astrophysik	Z. Astrophys.
Zeitschrift für Elektrochemie	Z. Elektrochem.
Zeitschrift für Kristallographie, Kristallgeometrie, Krystallphysik, Kristallchemie	Z. Kristallogr. Kristallgeom. Krystallphys. Kristallchem.
Zeitschrift für Metallkunde	Z. Metallk.
Zeitschrift für Naturforschung	Z. Naturforsch.
Zeitschrift für Naturforschung, Teil A Physik, Physikalische Chemie, Kosmophysik	Z. Naturforsch. Teil A
Zeitschrift für Physik	Z. Phys.
Zeitschrift für Physikalische Chemie (Frankfurt am Main)	Z. Phys. Chem. (Frankfurt am Main)
Zeitschrift für Physikalische Chemie (Leipzig)	Z. Phys. Chem. (Leipzig)
Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki [Soviet Physics-JETP]	Zh. Eksp. Teor. Fiz. [Sov. Phys. JETP]
Zhurnal Fizicheskoi Khimii [Russian Journal of Physical Chemistry]	Zh. Fiz. Khim. [Russ. J. Phys. Chem.]
Zhurnal Prikladnoi Spektroskopii [Journal of Applied Spectroscopy (USSR)]	Zh. Prikl. Spektrosk. [J. Appl. Spectrosc. (USSR)]
Zhurnal Tekhnicheskoi Fiziki [Soviet Physics-Technical Physics]	Zh. Tekh. Fiz. [Sov. Phys. Tech. Phys.]

APPENDIX H: SYMBOLS USED IN CORRECTING PROOF

Symbol	Meaning	Examples: As typeset and marked for correction	Corrected
	delete	data/ that we have accumulated	data that we have accumulated
	delete and close up	$A(x)$ X $B(x)$ is the term	$A(x)B(x)$ is the term
	close up	the product $A(x)$ $B(x)$	the product $A(x)B(x)$
	restore words crossed out	it is ~~not~~ true	it is not true
	indicates where to make insertion	colinear	collinear
	insert a period	. . . in our experiment	. . . in our experiment.
	insert a comma	However we . . .	However, we. . .
	insert a hyphen	unionized	un-ionized
	type or insert as subscript	α_2, A^{α}	α_2, A^{α}
	type or insert as superscript		
	insert a space	1536Å	1536 Å
	en dash	in the range 20-40 MeV	in the range 20–40 MeV
	em dash	Relation (14)-and only relation (14)-can . . .	Relation (14)–and only relation (14)–can. . .
	start a new paragraph	¶The state is represented by the Wheeler form of the vacuum functional. no ¶ Besides the well-known. . .	The state is represented by the Wheeler form of the vacuum functional. Besides the well-known. . .
	do not start a new paragraph		
	lower matter	$a+b=$ k p	$a+b=c+\mathbf{k}\cdot\mathbf{p}$
	raise matter		
	move matter to left	$x+y=$ z $+w$ (15)	$x+y=z+w$ (15)
	move matter to right		
	use lower-case letter	liquid-HE container	liquid-He container
	use capital letter	24.5 meV	24.5 MeV
	use small capital letter	Kr II	Kr II
	use roman type	Next (I) measured I in MeV.	Next I measured *I* in MeV.
	use italic type		
	transpose	conceive	conceive
	make boldface roman	$E \times H$	**E x H**
	make boldface italic	$E+H$	$E+H$
	indicates order in which corrections are to be made in a line	parametrization	parametrization

Bibliography

The list below includes a few works of reference that have been found useful.

Everyone who does any kind of writing needs to have a good dictionary at hand. The AIP standard is *Webster's Third New International Dictionary. Webster's Ninth New Collegiate Dictionary* is an abridged version.

Style manuals vary from the encyclopedic and invaluable *Chicago Manual of Style* to the very concise classic by Strunk and White. In between are the new versions of *Modern English Usage* and *Plain Words*; both have a British accent but are nonetheless very useful for the American writer and for those whose native language is not English. For scientific writing, see *The Technical Writer's Handbook*. Robert Day's entertaining *How to Write and Publish a Scientific Paper* is more than a style manual; it gives general information about the science-publishing process, although most examples are drawn from the biomedical sciences.

Edward R. Tufte's book on the graphical representation of data is a masterpiece. Read it for instruction and come away inspired.

Finally, the standard references on the definition and use of symbols and units are *Symbols, Units, Nomenclature and Fundamental Constants in Physics* and *Units of Measurement.*

Scientific writing

H. Ebel, C. Bliefert, and W. Russey, *The Art of Scientific Writing* (VCH, Weinheim, 1987).

Robert A. Day, *How to Write and Publish a Scientific Paper* (ISI, Philadelphia, 1979).

Matt Young, *The Technical Writer's Handbook* (University Science Books, Mill Valley, CA, 1989).

General style

The Chicago Manual of Style, 13th ed. (University of Chicago, Chicago, 1982).

Sir Ernest Gowers, *The Complete Plain Words*, 3rd ed. (Her Majesty's Stationery Office, London, 1986).

H. W. Fowler, *A Dictionary of Modern English Usage*, 2nd ed. (Oxford University, New York, 1965).

William Strunk, Jr. and E. B. White, *The Elements of Style*, 3rd ed. (Macmillan, New York, 1979).

Edward R. Tufte, *The Visual Display of Quantitative Information* (Graphics Press, Cheshire, CT, 1989).

Webster's Third New International Dictionary, unabridged, 3rd ed. (G. & C. Merriam, Springfield, MA, 1986).

Webster's Ninth New Collegiate Dictionary (G. & C. Merriam, Springfield, MA, 1985).

Metric units

E. Richard Cohen and Pierre Giacomo, *Symbols, Units, Nomenclature and Fundamental Constants in Physics* [International Union of Pure and Applied Physics, Document IUPAP-25 (SUNAMCO 87-1), 1987].

Units of Measurement, ISO Standards Handbook 2 (International Organization for the Standardization, Geneva, Switzerland, 1982).

APS publications

Peggy Judd, *Physical Review Input Guide for Author-Prepared Compuscripts*, 1st ed. (American Physical Society, New York, 1983).

Peggy Sutherland, *Physical Review Input Guide for T_EX Author-Prepared Compuscripts*, 1st ed. (American Physical Society, New York, 1989).

Physical Review Style and Notation Guide, compiled and edited by Anne Waldron and Peggy Judd (American Physical Society, New York, 1983).

Index

1997 ADDENDUM TO FOURTH EDITION OF AIP STYLE MANUAL

This addendum contains supplemental and revised information for several sections of the Fourth Edition of the AIP Style Manual. Much of what is contained here concerns electronic submission of text and figures to AIP, and is specific to the set of journals produced by AIP. For further information regarding journals published by AIP and its Member Societies, please visit the appropriate web site:

American Institute of Physics	www.aip.org
The American Physical Society	www.aps.org
Optical Society of America	w3.osa.org
Acoustical Society of America	www.asa.aip.org
The Society of Rheology	www.umecheme.maine.edu/sor/
American Association of Physics Teachers	www.aapt.org
American Crystallographic Association	www.hwi.buffalo.edu/ACA/
American Astronomical Society	www.aas.org
American Association of Physicists in Medicine	www.aapm.org
American Vacuum Society	www.vacuum.org
American Geophysical Union	earth.agu.org/kosmos/homepage.html

The information that follows is organized according to the section of the Style Manual to which it pertains.

II. D. SUBMISSION OF TEXT IN DIGITIZED FORM

AIP accepts author-prepared computer files for use in production. If you have used REVTeX, LaTeX, Word, or WordPerfect to compose your manuscript, AIP may be able to use your file to produce author proofs. If you are interested in participating in the program, please indicate so in the cover letter that accompanies your original submission. Please also include an electronic mail address if available. Do not send a disk with your original submission; wait for further instructions from the editorial office. Do not send the file to AIP Production until requested to do so.

AIP uses translation software to convert REVTeX, LaTeX, Word, or WordPerfect files into Xyvision composition files for production. For this project to be of benefit to both the author and the production staff, it is imperative that the guidelines as documented in either the REVTeX toolbox or the Word/WordPerfect author toolkit be followed precisely. Each file will be evaluated for appropriateness; authors will receive notice with their page proofs as to whether or not their file was used. Authors will also receive a feedback form with their proofs, detailing any problems AIP encountered in processing the file.

The REVTeX toolbox is available via anonymous FTP on the Internet from ftp.aip.org in the directory /pub/revtex. The Word/WordPerfect toolkit is also available via anonymous FTP from ftp.aip.org. Move to the directory /ems, then follow the instructions given on the screen. If electronic retrieval is not possible, you may receive the toolbox or toolkit on disk by contacting toolkits@aip.org.

The REVTeX toolbox and the Word/WP toolkit, as well as general information regarding the compuscript program, are accessible via the AIP Physics Information NETsite (www.aip.org/epub/compuscripts.info.html). The Word/WP author toolkit FAQ ("Frequently Asked Questions") may be found at www.aip.org/aip/toolkitf.html.

V. FIGURES

Illustrations published in the journal are either scanned by AIP using a digital scanner or received electronically from the author; they are then integrated with the text of the article, creating completely electronic pages. To ensure optimal quality, **we strongly encourage you to send electronic graphics files to AIP**, rather than laser output. This is particularly useful for halftone art (screened art), shaded figures, and combinations (line art + halftone) since computer-generated illustrations output to desktop laser printers produce a screen; screened figures are problematic due to the introduction during the scanning process of an unacceptable moiré interference pattern.

Please adhere to the following guidelines when preparing your illustrations for submission:

Sizing Illustrations (Electronic Graphics Files and Hardcopy)

- **Prepare illustrations in the final published size, not oversized or undersized.** Size your illustrations according to your journal's specifications. Submit each illustration at the final size in which it will appear in the journal. The standard is 8.5 cm maximum width (3-3/8 in. or 20.5 picas) for one column. This is especially important for screened or shaded illustrations, since reduction of screened/shaded originals during the digitizing process compounds problems with moiré patterns.

- **Ensure a minimum of 8-point type size (2.8 mm or 1/8 in. high) and 1-point line width within illustrations**. Ensure that line weights will be **0.5 points** or greater in the final published size. Line weights below 0.5 points will reproduce poorly. Avoid inconsistencies in lettering within individual figures, and from one figure to the next. Lettering and symbols cannot be handwritten. Avoid small open symbols that tend to fill in if any reduction is necessary.

Preparation of Hardcopy Illustrations for Scanning

- **Number figures in the order in which they appear in text.** Label illustrations with their number, the name of the first author, and the journal, on the **front** of the figure well outside the image area.

- **Place only one figure per page (including all parts).** Place all parts of the same figure on one sheet of white bond paper, spaced 1/4 in. or 6 mm apart, and leaving a 2 in. or 5 cm bottom margin. If necessary, use a glue stick or wax on the back of the illustration. Label all figure parts with (a), (b), etc. Make sure each figure is straight on the page.

- **Do not use correction fluid or tape on illustrations.** The scanner is extremely sensitive and reproduces all flaws (e.g., correction fluid, tape, smudges, dust). *Do not write on the back of the figure* because it will be picked up by the scanner.

- **Authors' laser-generated graphics are acceptable only if the lettering and lines are dark enough, and thick enough, to reproduce clearly,** especially if reduction is required. Maximum black–white contrast is necessary. Choose a laser printer with the highest dot-per-inch (dpi) available (i.e., the highest resolution possible). Remember that fine lines in laser-generated graphics tend to disappear upon reduction, even if the oversized original looks acceptable. **Photocopies of artwork are not acceptable** — originals must be submitted for production.

- **Submit continuous-tone photographs in final published size on white glossy or matte paper.** Avoid glossy paper stock that is off-white, ivory, or colored because contrast within the illustration will be lost in reproduction. Print the photograph with more contrast than is desired in the final printed journal page. Avoid dull, textured paper stock, which will cause illustrations to lose contrast and detail when reproduced.

Preparation of Electronic Graphics Files

- **Acceptable formats:** Graphics must be submitted as PostScript, EPS (using either Arial or Times Roman fonts), or TIFF (lzw compressed). Do not send application files, e.g., Corel Draw, etc.

- **Settings:** Set the graphic for **600 dpi** resolution for line art, **264 dpi** for halftones (noncompressed), and **600 dpi** for combinations (line art + halftone). Save the files to grayscale (B/W), not color; electronic graphics files for color figures are not currently being accepted, thus color figures must be submitted via hardcopy.

- Make sure there is only **ONE** figure per file. Each figure file should include all parts of the figure. For example, if Figure 1 contains three parts (a, b, c), then all of the parts should be combined in a single file for Figure 1.

- You are still required to send hardcopies of all figures to the editor, along with a hardcopy of the manuscript.

- Do not FTP the graphics files to the editorial office or AIP unless or until instructed to do so. Full instructions will be sent to you twice: once on a hardcopy form after initial submission of your manuscript, and again via e-mail after your manuscript has been accepted for publication. Adherence to electronic submission instructions is crucial. If your electronic files are received after AIP has already processed the hardcopy illustrations, the electronic files will not be used.

Detailed instructions for submitting electronic graphics to AIP and a glossary of terms may be found on the AIP Physics Information NETsite (www.aip.org/epub/submitgraph.html).

APPENDIX A: JOURNALS OF AIP, MEMBER SOCIETIES, AND PARTICIPATING AFFILIATES

AIP Conference Proceedings
Charles Doering, Senior Editor
American Institute of Physics
500 Sunnyside Blvd.
Woodbury, NY 11797

American Journal of Physics
Robert H. Romer, Editor
Amherst College
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