

**PHYSICAL REVIEW C**  
**INFORMATION FOR CONTRIBUTORS**

(Revised July 2012)

Manuscripts that report the results of research in nuclear physics and related fields may be submitted to *Physical Review C*. The manuscripts must contain new results and not be in editorial process at another journal. (For details, see “*Physical Review C Editorial Policies and Practices*” in this issue.)

Articles published in *Physical Review C* are grouped under **headings** in the table of contents. The headings now used are as follows:

- Nucleon-Nucleon Interaction, Few-Body Systems
- Nuclear Structure
- Nuclear Reactions
- Relativistic Nuclear Collisions
- Hadronic Physics and QCD
- Electroweak Interaction, Symmetries
- Nuclear Astrophysics

Authors should suggest the headings that are most appropriate.

This journal, and more detailed information about it, can be found at <http://prc.aps.org/>. Prospective authors are particularly advised to consult the information accessible via the Authors and Manuscript Submission subpages. Those looking for a specific known file may find it more convenient to consult the alphabetical listing available via the Forms and Memos link on the Authors, General Information subpage, in the Manuscript Preparation section.

Manuscripts may be **submitted** by a variety of electronic modes (including via e-print servers, direct Web upload, and email). Web or e-print submission is strongly preferred. Interactive submission forms are an integral part of the submission process for the e-print and Web modes. These forms aid authors in supplying all the information needed in a structured format which furthers efficient processing; they also provide a location for additional “free form” information.

If you do not use the submission forms noted above, your submission letter should specify the **author** to whom correspondence should be addressed, and give all available communications information for this individual (postal and email addresses, phone and fax numbers). Please specify journal and section to which the paper is submitted, and give Physics and Astronomy Classification Scheme<sup>®</sup> (PACS) index categories which are available via the APS Web server at <http://publish.aps.org/PACS/>. These categories are used in preparing the annual subject index.

For detailed information about **electronic submissions**, see <http://authors.aps.org/ESUB/>. Properly prepared electronic submissions are **exempt from publication charges**. Those that use APS macro packages may qualify for the compuscript production program, under which author-supplied files are converted directly to production format and coding, rather than being rekeyed for publication. Receipt of an electronic submission will be acknowledged by email within 24 hours. **Figures** for an electronic submission must be received in at least review-quality form before editorial processing can begin. Refer to the online documentation for more detailed instructions.

Authors of manuscripts that have been sent for external review are directed, via email, to an online, interactive service that guides the completion of the ‘publication rights’ agreement(s), such as the APS Transfer of Copyright agreement, appropriate to their work. While such agreements take effect only upon acceptance of the manuscript for publication in an APS journal, the prompt completion of this process can prevent unnecessary delays; accepted manuscripts will not be forwarded to production until APS is in receipt of the agreement(s) associated with them.

The Division of Nuclear Physics of the APS requests that authors provide a **Keyword Abstract**. Please consult [http://www.nndc.bnl.gov/nndc/physrev\\_keywords/](http://www.nndc.bnl.gov/nndc/physrev_keywords/) for further information and submission details. The Keyword Abstract should be forwarded to the National Nuclear Data Center.

**Manuscripts** should be written in scientific English, in a style consistent with that of the journal. It is not possible for the editorial office to undertake extensive corrections of manuscripts, due to time constraints and the risk that the authors' meaning might be distorted. Manuscripts requiring extensive corrections are therefore returned to the authors. For this reason, authors whose native language is not English are urged to seek help from a native English speaker. For **general format and style** consult recent issues of this journal and the *Physical Review Style and Notation Guide* at <http://authors.aps.org/STYLE/>. Additional style guidelines can be found in the Fourth Edition of the *AIP Style Manual*, available at <http://www.aip.org/pubservs/style.html>.

When a manuscript is **resubmitted**, please include a summary of changes made and a brief response to all recommendations and criticisms. The interactive resubmission forms available on our Web server may be used for transmission of modified manuscripts and figures. These forms should also be used when a manuscript previously submitted to one APS journal is resubmitted to another. Send the complete file for the text if there have been any changes. Please refer to the online documentation for more detailed instructions. For any resubmission, please state whether or not the figures have been modified, and supply new electronic figures if there have been such changes. It is only necessary to resend the "original" figures if the previous versions are no longer valid. Please update any other information (e.g., address and communication information) that has changed or will change since initial submission.

The writing of the **title** deserves special care. It should convey the greatest amount of information in the smallest number of words. Words that do not carry information, such as "The...", "A...", "On...", "Investigation of...", "Study of...", should be omitted. For manuscripts submitted to the Comments section, "Comment on..." followed by the title of the paper to which the Comment refers is, however, good practice. Do not use in the title words that praise the quality of the work (precise, important, accurate), the name of the accelerator or type of detector used, names of people or places, coined words or acronyms, "More about...", "...revisited", or dangling participles (...using...). Do not use serial numbers in titles unless the number is followed by a specific title, such as "Inelastic scattering of protons. IV. Coupled channels analyses." If you wish to use a serial number, please provide information on the other published articles in the series.

The names of **authors** may be listed in any order in the byline at the beginning of a paper. The author who submits the paper is responsible for ensuring that all coauthors have approved the paper and for checking that the form of each name (e.g., initials versus full names) is that normally used by the author.

**Affiliations** of authors should be given without abbreviation. (Use Massachusetts Institute of Technology, not MIT.) Give the city, state, and zip code for U.S. addresses; add the country for other addresses. Affiliations must be institutions, not conferences, collaborations, or temporary meeting places.

If the authors are at different institutions, they may be grouped by institution with the name of the institution following each group. If the authors are not grouped by institution, the names of institutions may be repeated following the appropriate authors or groups of authors. If this becomes cumbersome, the names of institutions may be listed following the list of authors. Each author's name should then be followed by a superscript number (or numbers) that refers to a similar superscript number preceding the appropriate institution (or institutions). Normally, the most concise presentation is preferred.

Footnotes to an author's name or address are intended to facilitate locating or communicating with an author. In many cases, it can be helpful to identify an author as "spokesperson" or "author to whom correspondence should be addressed." Footnotes giving email addresses of one or more corresponding authors are strongly encouraged. All information concerning research support should appear in the acknowledgments. Footnotes which describe an author's position or title are not acceptable.

Every paper must have an **abstract**. It should be about 5% of the length of the article, but less than 500 words. It should state all subjects about which new information is given and the conclusions and results. For experimental papers it should specify clearly what quantities were measured, what nuclides were studied at what energies. It should not contain footnotes, coined words, or acronyms that are not explained.

In an effort to improve the information conveyed to readers authors are strongly encouraged to prepare a **structured abstract** that contains sections summarizing the paper's **Background, Purpose, Methods, Results, and Conclusions** (see the September 2011 Editorial at <http://prc.aps.org/edannounce/PhysRevC.84.030001> for the rationale and an example). Details of implementation are given in the REVTeX 4.1 guides available at <http://authors.aps.org/revtex4/>.

*Physical Review C* tries to follow the recommendations on **symbols and units** of the International Union of Pure and Applied Physics (IUPAP) and of the National Institute of Standards and Technology. Metric units (preferably SI), not British units, are used, unless the British unit is part of the name of an object.

Recommended abbreviations for frequently used terms are listed below along with some common misuse.

Use	Do Not Use
$\mu\text{m}$	$\mu$
nm	m $\mu$
fm	F (F is for farad)
g	gm
A	amp
K	$^{\circ}\text{K}$
sr	Sr, ster, str
u	amu
$\text{cm}^3$	cc
deg	DEG, DEG., deg.
keV	KEV, KeV
MeV	Mev, MEV
MeV/nucleon	MeV/u, MeV/amu, MeV/A
$\mu_N$	n.m.
c.m. (=center of mass)	CM
arb. units	a.u. (a.u. is for atomic units)

*Physical Review C* follows the recommendations of the S.U.N. Commission of IUPAP on the symbols to be used for nuclides and their states. The nucleon number (mass number) of a nuclide is shown as a left superscript ( $^{14}\text{N}$ ). A right superscript is used for indicating a state of ionization ( $\text{Ca}^{2+}$ ) or an excited state ( $^{110}\text{Ag}^m, ^{14}\text{N}^*$ ). A right subscript is used for indicating the number of atoms in a molecule ( $^{14}\text{N}_2$ ). For bombarding particles,  $n$ ,  $p$ ,  $d$ ,  $t$ ,  $h$ , and  $\alpha$  may be used, but not  $\tau$ . For other bombarding particles, only the usual symbols  $^6\text{Li}$ ,  $^{12}\text{C}$ , ... should be used. For target nuclides, use  $^1\text{H}$ ,  $^2\text{H}$ ,  $^3\text{H}$ ,  $^3\text{He}$ ,  $^4\text{He}$ , ... . Do not use D, T, ... .

The preferred notation for a differential **cross section** is  $\sigma(\theta)$ ,  $\sigma(E, \theta)$ , i.e., the angle or energy should be shown as an argument. The derivative notation  $d^2\sigma/d\Omega dE$  is acceptable;  $d^2\sigma$  by itself or  $d\sigma/d\Omega dE$  is not. The notation  $dM/dA$  or  $ds/dZ$  is acceptable when it refers to a mathematical relationship, such as the semiempirical mass formula, but not for the characterization of data since  $A$  and  $Z$  are not continuous.

**Notation** should be clear, compact, and consistent with standard usage. **Equations** should be neatly formatted, punctuated, and aligned to bring out their structure, and numbered on the right. (a) Diacritical marks (tildes, etc.) can be put over any symbol, including indices. (b) Three-vectors are generally set in roman boldface type. More general vectors, matrices, etc., are usually set in lightface italic type, although boldface may alternatively be used. (c) Be careful when using the solidus ( $/$ ) in fractions. For example,  $1/2a$  means  $1/(2a)$ , not  $(1/2)a$ . Use appropriate bracketing if needed to ensure clarity.

**References** cited in text material must be numbered in order of their first citation, and should appear in a separate double-spaced list at the end of the text. They should be designated by on-line Arabic numerals enclosed in square brackets. **Footnotes** (for subsidiary remarks, not for references) may be placed at the bottoms of published pages. Such footnotes to text materia should be designated by superscript numerals, numbered consecutively throughout the paper, and placed at the bottoms of the manuscript pages on which they are cited. Authors who do not wish to use this option should combine references and footnotes in a single list, designated by on-line numerals in square brackets, numbered consecutively in order of first citation, and placed at the end of the text. References and footnotes within tables should be designated by superscript lower-case roman letters and given at the end of the table.

In preparing the **list of references** for papers submitted to *Physical Review C* the author should be guided by the *Physical Review Style and Notation Guide*, especially Table I and the list of Journal Title Abbreviations, and by the corresponding material in the *AIP Style Manual*. The following describes the practices of *Physical Review C*:

*et al.* The use of *et al.* (no comma before *et*) is encouraged in the body of the paper, but discouraged in the references. The names of all authors should be given in the references, unless the number of authors is greater than **ten**.

(in press) means that the paper has been accepted for publication in a journal (or a conference proceedings). The name of the journal must be specified. If the paper has been published when the author receives the proofs, the reference should be updated in proof.

(submitted or to be submitted) means that the paper has been submitted or will shortly be submitted for publication. The name of the journal, book, or conference proceedings must be specified.

(unpublished) means that the information is unavailable in formally published form. Ph.D. theses need not be marked (unpublished), since copies can be purchased.

Conference Proceedings. Name, place, and year of the conference should be specified. Specify the editors and publisher if possible. Give page number.

Preprints and Reports (electronic or hard copy). Give name of laboratory, preprint or report number, and year. Give the title if possible and especially if a preprint or report number is not available.

Books. Give publisher, year, page number.

Journal references. Phys. Rev. C **20**, 195 (1979). Nucl. Phys. **A249**, 253 (1978). (Note difference.) For Annals of Physics use Ann. Phys. (N.Y.).

(private communication) means that the information is not available either in published or report form and acknowledges the receipt of information from another source. References to private communications in which the name of one of the authors appears are not acceptable.

References to papers published in peer-reviewed journals are considered primary references. References to e-print archives should not be used in place of primary references.

It is important to confirm the accuracy of bibliographic information in references. This has become more important now that the journal is online; establishing functional **hyperlinks** from reference lists to bibliographic and document databases depends on the accuracy of the data contained in the anchor reference. Since at the present time such links work only from the reference section, work cited anywhere in the paper, including in figure and table captions and in “Note(s) added,” should be included in the reference section.

**Acknowledgments** of support must be placed in an acknowledgments paragraph at the end of the text of a manuscript. Not all types of acknowledgments are appropriate for the *Physical Review*. We do not include acknowledgments to those who helped in the preparation of the document being published; to referees or editors (unless they were involved before the paper was first written); to those who contributed general encouragement (family, friends) or services that were not directly part of the research. References to positions, titles, and awards are inappropriate as are dates associated with awards. Examples of suitable acknowledgments are thanks to other scientists for scientific guidance given in discussions or by the communication of results,

mention of technical assistants who helped in the actual research, and citation of funding agencies that sponsored the work. Acknowledgments should be a simple statement of thanks for help and may not be a dedication or memorial. Acknowledgments to people should precede those of financial support.

Separate **tables** (numbered in the order of their appearance) should be used for all but the simplest tabular material; they should have captions that make the tables intelligible without reference to the text. Units should be given in the column headings. The decision on whether results should be published in long tables depends on the precision of the data, i.e., whether they can be read accurately enough from a figure, and on how many readers are likely to use the numbers relative to the space needed in the journal. If experimental results are likely to be used as reference values by other authors, the publication of the numbers is desirable. Material more extensive than is appropriate for the journal article, or of special types (e.g., color figures, multimedia, program files) may be deposited as Supplemental Material. Information is available via the Authors subpage of [prc.aps.org](http://prc.aps.org), in the Manuscript Preparation section. If additional numerical data can be obtained from a data center, from the author, or another source, either as tables or in electronic form, indicate how and in what format they can be obtained.

**Figures** should be planned for the column width (8.6 cm or  $3\frac{3}{8}$  in.) of the journal. If the detail shown requires it, 1.5 or 2 columns may be used. Authors are encouraged to submit all figures electronically; refer to the online instructions for more details. All figures must be prepared so that the details can be seen after reproduction. They must have a clear background and unbroken lines with as much black-white contrast as possible. The symbol width and lettering height on the journal page should be at least 2 mm. Avoid small open symbols that tend to fill in, small dots and decimal points, and shading or cross-hatching that is not coarse enough to withstand reproduction. Curves should be smooth; curves and lines should have consistent line widths of sufficient weight [final weight of at least 0.18 mm (0.5 point)]. The resolution of the drawing software and output device should be set as high as possible (preferably 600 dpi or higher).

Figures should be numbered in the order in which they are referred to in the text. Each figure must have a caption that makes the figure intelligible without reference to the text. Text should be placed in the caption, not on the figure. Groups of figures that share a (single) caption must be labeled “(a), (b),” etc. The figure itself should have properly labeled axes with correctly abbreviated units enclosed in parentheses. Use consistent lettering and style as in the body of the text (use correct capitalization, unslashed zeros, proper exponential notation, superscripts and subscripts, decimal points instead of commas, etc.). Use the form  $R$  ( $10^3 \Omega$ ), not  $R \times 10^3 \Omega$ . Use half spacing within compound units, not hyphens or periods. Avoid ambiguous usage of the solidus (“/”), e.g., (mb/MeV sr), not (mb/MeV/sr). When possible, integer numbers should be used on the axis scales of figures, e.g., 1, 2, 3, or 0, 5, 10, not 1.58, 3.16, 4.75. Decimal points must be on the line (not above it); do not use commas instead. Use the same number of digits to the right of the decimal point for all numbers on the axis scales. A number must be both before and behind the decimal point. e.g., 0.2, not .2. For complete instructions see the *Physical Review Style and Notation Guide* or the *AIP Style Manual*.

Photographic images (either grayscale or color) should be submitted electronically as high-resolution JPEG or PNG files.

In preparing figures, care should be taken to present the scientific results accurately. If images used in any of the figures have been **manipulated**, except for adjustments that affect the picture as a whole (e.g., overall brightness), the modification should be described clearly in the caption or text.

Some figures might be more effective in **color**. The cost of printing illustrations in color, which may be significant, must be borne in full by the respective authors and their institutions.

If color is desired in the print version of the journal as well as in the online version, the author must clearly indicate which figures are intended to be printed in color as part of the submission process. Information about our pricing and payment policy for color figures in the print journal may be found at: <http://authors.aps.org/tips.html>.

The relation of the paper to *previously published* work should be explained clearly. This should include the work of other authors and previously published work of the present authors, including meeting abstracts and conference reports. If the present results correct, supplement, or supersede previous results, this should be stated. (Preprints and internal laboratory reports are not considered publications.) Indicate which results are new, as distinguished from results obtained previously.

In order to **reproduce** figures, tables, etc., from another journal, authors must show that they have complied with the requirements of the publisher of the other journal, possibly including written agreement of both publisher and author of the originally published work. (If the original journal is published by APS, only the written agreement of the original author is required to reproduce a few figures or tables.)

Enough information about the **apparatus** and methods should be presented to permit evaluation of the procedure. For example, for a scattering experiment, give relevant dimensions, target thickness and composition, energy resolution, and angular resolution. If an accelerator was used, it should be identified.

An example of **data** should be presented (such as an energy distribution, time-of-flight spectrum, or coincidence spectrum) to show the quality of the data. If results depend on theoretical assumptions, state what the assumptions are. If the measurement is relative to a standard, such as an energy or cross section, state what reference value was used. If results depend on a sign convention, state the convention and give references.

Specify **uncertainties**. Distinguish statistical and other errors. In the case of measurements relative to a standard, state whether the error includes the error in the standard.