Physics 451/452/495/496 Style Guide

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December 18, 2001

Abstract

An abstract briefly summarizes the content of your paper. It is not very long, but should say everything important about your work—what you are measuring or calculating, and what your results are.

1 Form

Senior research reports and honors theses may be less compact than papers intended for publication in a technical journal, but they should be written in the same style. You should write so that fellow physics majors—equipped only with your paper, its references, and a physics library—can understand your work thoroughly. This requires the combined arts of good organization, well-crafted explanation, excellent English composition and coherent page layout. The only enduring record of your work is the written thesis.

In 30 seconds someone should get the gist of your work by reading the abstract. In 5 minutes that person should obtain a reasonable understanding of your work by studying the figures and tables with their captions. In a concentrated effort your reader should find every relevant detail either in your paper or in its references.

Use a single font (preferably a serif font such as Times Roman or Palatino in 11 or 12-point type) for the whole document. Captions may be one or two points smaller than the normal text. Bold face and italics may be used as necessary.

1.1 Introduction

The introduction provides the context necessary to understand your paper's importance. It should summarize the current state of knowledge in the field, including citations of primary sources for all relevant work, and state the question your work is trying to answer.

1.2 Physics Background

Although the physics background of a paper may be incorporated into the introduction, you must present the theoretical context and framework for the present study somewhere.

1.3 Description of Method

Describe in detail the method—whether theoretical or experimental—you employed to tackle the problem at hand. This includes a description of the equipment required, the reasons the apparatus was designed and built in a particular way, and the mathematical techniques needed to solve your problem. Do this with the help of figures, and make sure to include all important details.

1.4 Data Collection and Analysis

A good paper contains a careful account of what you have done to get your results, whether that be the details of a calculation, an experimental procedure or the analysis of data. Essential to this section is a determination of the accuracy of your results.

1.5 Interpretation of Results

Any result you obtain needs to be put into the context of other's work on the subject. How do your theoretical calculations agree with existing data; how do your data agree with other data or theoretical predictions?

1.6 Conclusions

Briefly summarize how your results impact your field of study. This might include suggestions for further study.

2 Figures

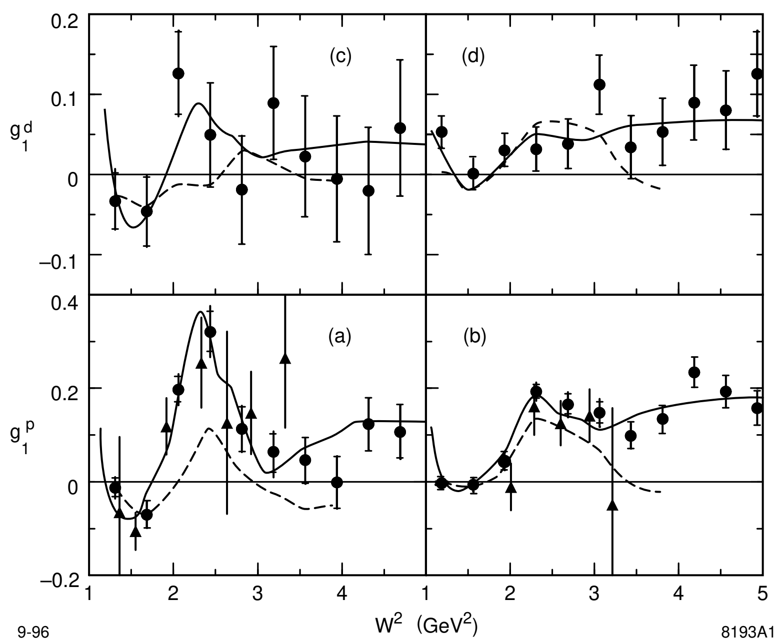

Figure 1: Measurements of g_1 as a function of W^2 for the proton at (a) 4.5° and (b) 7°; and for the deuteron at (c) 4.5° and (d) 7°. The present data (circles) are plotted together with the data of Baum *et al.*[1] (triangles), our Monte Carlo simulation (solid line), and the model AO of Burkert and Li[2] (dashed line). The full error bars correspond to statistical and systematic errors added in quadrature, whereas the cross bars indicate statistical errors only.

Table 1: Integrals Γ of the structure functions g_1 for the proton (p), deuteron (d) and neutron (n). The measured sum Γ_{res} for the resonance region ($W^2 < 4$ GeV^2) is listed separately from the totals Γ_{tot}, which includes the deep-inelastic region as given by fits to the world's data.

Q^2 (GeV^2)		$\Gamma_{\rm res}$ ($\pm$stat.$\pm$syst.)	$\Gamma_{\rm tot}$($\pm$stat.$\pm$syst.)
0.5	p	0.026$\pm$0.008$\pm$0.008	$0.049 \pm 0.008 \pm 0.013$
0.5	d	0.000$\pm$0.013$\pm$0.008	$0.003 \pm 0.013 \pm 0.010$
0.5	n		$-0.043 \pm 0.029 \pm 0.025$
1.2	p	0.040$\pm$0.003$\pm$0.004	$0.100 \pm 0.005 \pm 0.012$
1.2	d	0.026$\pm$0.006$\pm$0.004	$0.043 \pm 0.008 \pm 0.007$
1.2	n		$-0.006 \pm 0.019 \pm 0.020$

Figures must:

- be centered horizontally on the page;
- be completely legible at a distance of 1 meter from the page;
- not be cluttered in any way that detracts from the message;
- be thoroughly explained in the caption which also names the figure (*e.g.* Figure 1);
- distinguish different sets of data by symbol (and also color);
- have visible scales and clear labels on the bottom and left axes;
- be mentioned by name in the body of the text (*e.g.* "Fig. 1 shows ...");
- and be embedded in the text rather than stuck at the end of the document.

3 Tables

Tables must:

- be set off from but embedded in the normal text;
- be centered horizontally on the page;
- use horizontal (and possibly vertical) lines to separate groups of rows or columns;
- contain an identifying row or column describing the other table elements;
- have a caption that fully describes the content of the table;
- be as economical as possible (*i.e.* don't repeat any information such as units on every line);
- and be referred to by name within the body of the text. (*i.e.* "Table 1 indicates that ...").

4 Equations

Equations must:

- be centered horizontally on the page and separated from the text above and below;
- be numbered along the right margin with a numeral within parentheses;
- use a serif italic font of a single point size consistent with the rest of the document;
- have attractive spacing so that they are easily readable;
- and have the look and feel of those in Physical Review or in a McGraw-Hill physics text.

5 References

References are the skeleton on which a paper is built. Without them, your paper simply cannot stand up.

References:

- establish the context for your work;
- describe in detail the concepts or measurements that you do not have space to discuss;
- give credit to others who have done work on your subject (It takes a community to do science—one person alone can only work on a small part of the puzzle. Your references establish the connections to that community);
- back up statements that you make;
- and provide the theoretical and experimental input for interpreting your results.

In physics papers, references are numbered and printed at the end of the document (rather than as footnotes). Cited references are indicated by a superscript, or a number in [brackets] immediately following the word most indicative of the referenced work (*e.g.* The European Muon Collaboration has claimed[3] that...). The form should adhere to the APS guidelines for Physical Review as exemplified below, including citations of preprints[4] and web sites[5]. Volume numbers are in bold face.

6 English Usage

A physics paper is subject to all the rules of English writing in Strunk and White[6] or another style guide. Get one and use it.

Here are some specifics for physics papers:

- Number all pages, preferably on the bottom middle of the page.
- “Fig. 1,” “Table 4,”, “Eq. 3,” “Eqs. 4–7,” “Run 13,” “Ref. [13],” and “Section 3.4” are all proper nouns and need to be capitalized.
- List references in the order they are cited in the paper.

- Do not start a sentence with a variable.
- An equation, even one set off from the rest of a paragraph, is part of a complete sentence that starts with a capital letter, ends with a period, and makes sense when read out loud.
- The word "data" is plural; "phenomenon" is singular, "phenomena" is plural; "Affect" and "effect" as nouns and verbs have four different meanings.
- Write "Ref. [13]" rather than "[13]" in a sentence referring to Reference 13.
- Hyphenate two nouns used as an adjective (*e.g.* "We have found the center of mass because the center-of-mass frame has certain advantages" or "We measured the pulse heights and generated a pulse-height distribution.").
- Avoid using the same significant word twice in one sentence.
- Avoid the passive voice. The active voice forces one to use varied and accurate verbs. Some scientists insist that "I" or "we" have no place in an objective scientific paper; however, this leads to animism (experiments and calculations doing things previously thought possible only of humans), or to dreadfully dull passivity (experiments and calculations being done without the watchful eye of a human agent).
- Use positive, rather than negative, constructions (*e.g.* "His eyes are blue", rather than "His eyes are not brown.").
- Match tenses within a sentence (*e.g.* "I came; I saw; I conquered." rather than "I come; I saw; I will conquer.", or "He diced, sliced and pickled." rather than "He had diced, has sliced, and pickled.").
- Use "in which" to complete a sentence with an equation in it (*e.g.* We find that $F = ma$, in which m is the mass of the particle and a is its acceleration).
- Use the same serif italic font for all variables within the text and in the equations.
- Edit your document; examine carefully each sentence for meaning, content, efficiency and grammar, and make appropriate changes.

References

[1] G. Baum *et al.*, Phys. Rev. Lett. **45**, 2000 (1980).

[2] V. Burkert and Z-J. Li, Phys. Rev. D **47**, 46 (1993).

[3] J. Ashman *et al.* [European Muon Collaboration], "An investigation of the spin structure of the proton in deep inelastic scattering of polarized muons on polarized protons," Nucl. Phys. **B328**, 1 (1989).

[4] A. Freund and M. McDermott, hep-ph/0106124.

[5] Y. Roblin and F. Sabatié, JLAB Proposal E-00-110,
www.jlab.org/exp_prog/generated/halla.html

[6] W. Strunk, E.B. White and R. Angell, "The Elements of Style, 4th ed.," (Allyn & Bacon, Boston, 2000).