Title of manuscript:
Force line breaks with \\

A. A. Author and B. B. Author*
Lines break automatically or can be forced with \\
Authors' institution and/or address
*This line break forced with *

C. C. Author
Second author institution and/or address
*This line break forced with *

(October 22, 1997)

The author will not know the received date when the compuscript is first submitted; production will insert this. Every article includes an abstract. The abstract is a concise summary of the work covered at length in the main body of the article. It is used for secondary publications and for information retrieval purposes. Valid PACS numbers should be entered after the abstract is finished, using the `\pacs{#1}` command.

Valid PACS appear here. `\pacs{}` should always be input, even if empty.

I. FIRST-LEVEL HEADING: THE LINE BREAK WAS FORCED VIA \\

Here is the first sentence in Sec. I, demonstrating section cross-referencing. Note that this sample file was run with the eqsecnum option selected. Here is an openface one: $\mathbb{1}$.

This file (apssamp.tex) contains comments marking the start/end of the pages of galley-style output. This should make it easier to compare the output to the input file.

A. Second-level heading: The line break was forced via \\

Here is the first sentence in Sec. I A, demonstrating section cross-referencing. The command `\narrowtext` will make the text this width. The command `\widetext` will make the text the width of the full page, as on page 4. A blank input line tells TEX that a new paragraph begins.

The width-changing commands only take effect in galley style (the default style). Preprint style gives output of a constant width.

This file may be run in both preprint and galley styles. Preprint format is used for submission purposes. Galley format is used to mimic final journal output.

When commands are referred to in this example file, they are always shown with their mandatory arguments, using normal TEX format. In this format, `#1`, `#2`, etc. stand for mandatory author-supplied arguments to commands. For example, in `\section{#1}` the `#1` stands for the text of the author's section heading, and in `\title{#1}` the `#1` stands for the title of the paper.

Reference citations in text use the command `\cite{#1}`. `#1` may contain letters and numbers. In the reference section of this paper each reference is "tagged" by the `\bibitem{#1}` command. `#1` should be *identical* in both commands. The proper form for citing in text is `\cite{#1}`, and the result is shown here [1,2]. We will cite other people [1,3] and journals here. We also cite other people again (Refs. [1] and [3]). It is worth mentioning that REVTEX "collapses" lists of reference numbers where possible. We now cite everyone together [1–3], and once again (Refs. [1–3]).

When the `prb` option is used, the command `\onlinecite{#1}` will put the reference citations on-line. It was used in the preceding paragraph. Note that the location of citations must be adjusted to the reference style: the superscript references in `prb` style must appear after punctuation; other styles must appear before any punctuation [4]. This sample was written for the regular (non-`prb`) citation style, but invoking the `prb` option will show the results of the command `\onlinecite{#1}` in the preceding paragraph.

II. DISPLAYED EQUATIONS

A. Another second-level heading

*1. Third-level heading: The line break was forced via *

Here is the first sentence in Sec. II A 1, demonstrating section cross-referencing. In LaTeX there are many different ways to display equations, and a few preferred ways are noted below. Displayed math will center by default.

a. Fourth-level heading: Single-line equations. Below we have single-line equations with numbers; this is the most common type of equation in *Physical Review*:

$$\chi_+(p) \lesssim [2|\mathbf{p}|(|\mathbf{p}|+p_z)]^{-1/2}\begin{pmatrix}|\mathbf{p}|+p_z\\ px+ip_y\end{pmatrix}, \tag{2.1}$$

$$\left\{1\!\!1234567890abc123\alpha\beta\gamma\delta1234556\alpha\beta\frac{1\sum_b^a}{A^2}\right\}. \tag{2.2}$$

Note the open one in Eq. (2.2).

Not all numbered equations will fit within a narrow column this way. The equation number will move down automatically if it cannot fit on the same line with a one-line equation:

$$\left\{ab12345678abc123456abcdef\alpha\beta\gamma\delta1234556\alpha\beta\frac{1\sum_b^a}{A^2}\right\}. \tag{2.3}$$

When the `\label{#1}` command is used [cf. input for Eq. (2.2)], the equation can be referred to in text without your knowing the equation number that TEX will assign to it. Just use `\ref{#1}`, where `#1` is the same name that you used in the `\label{#1}` command.

The `\FL` and `\FR` commands will set displayed math flush left and flush right, respectively. Just insert the `\FL` or `\FR` command before the displayed math begins. For example, here is an equation flushed left:

$$\left\{ab12345678bcdef\alpha\beta\gamma\delta1234556\alpha\beta\frac{1\sum^a_b}{A^2}\right\}. \tag{2.4}$$

You shouldn't need `\FL` and `\FR` very often.

If you have a single-line equation that you don't want numbered, you can use the `\[`, `\]` format:

$$g^+g^+ \rightarrow g^+g^+g^+g^+ \dots ~,~~q^+q^+\rightarrow q^+g^+g^+ \dots ~.$$

2. Multiline equations

Multiline equations are obtained by using the `\begin{eqnarray}`, `\end{eqnarray}` format. Use the `\nonumber` command at the end of each line where you do not want a number:

$$\begin{aligned}{\cal M}=&ig_Z^2(4E_1E_2)^{1/2}(l_i^2)^{-1}\delta_{\sigma_1,-\sigma_2}(g_{\sigma_2}^e)^2\chi_{-\sigma_2}(p_2)\\ &\times[\epsilon_jl_i\epsilon_i]_{\sigma_1}\chi_{\sigma_1}(p_1),\end{aligned} \tag{2.5}$$

$$\begin{aligned}\sum|M^{\text{viol}}_g|^2 &= g^{2n-4}_S(Q^2)~N^{n-2}(N^2-1)\\ &\times \left(\sum_{i<j}\right)\sum_{\text{perm}}\frac{1}{S_{12}}\frac{1}{S_{12}}\sum_\tau c^f_\tau~.\end{aligned} \tag{2.6}$$

Note: do not use `\label{#1}` on a line of a multiline equation if `\nonumber` is also used on that line. Incorrect cross-referencing will result.

If you wish to set a multiline equation without *any* equation numbers, you can use the `\begin{eqnarray*}`, `\end{eqnarray*}` format:

$$\begin{aligned}\sum|M^{\text{viol}}_g|^2 &= g^{2n-4}_S(Q^2)~N^{n-2}(N^2-1)\\ &\times \left(\sum_{i<j}\right)\left(\sum_{\text{perm}}\frac{1}{S_{12}S_{23}S_{n1}}\right)\frac{1}{S_{12}}~.\end{aligned}$$

To obtain numbers not normally produced by the automatic numbering, use the `\eqnum{#1}` command, where `#1` is the desired equation number. For example, to get an equation number of (2.6′),

$$g^+g^+ \rightarrow g^+g^+g^+g^+ \dots ~,~~q^+q^+\rightarrow q^+g^+g^+ \dots ~. \tag{2.6′}$$

A few notes on `\eqnum{#1}`. The `\eqnum{#1}` must come before the `\label{#1}`, if any. The numbering set with `\eqnum{#1}` is *transparent* to the automatic numbering in REVTEX; therefore, you must know the number ahead of time, and *must* make sure that the number set with \eqnum{#1} stays in step with the automatic numbering. \eqnum{#1} works with both single-line and multiline equations. You could, if you wished, do all the numbering in a paper manually with \eqnum{#1}.

Enclosing single-line and multiline equations in \begin{mathletters} and \end{mathletters} will produce a set of equations that are "numbered" with letters, as shown in Eqs. (2.7a) and (2.7b) below:

$$\left\{abc123456abcdef\alpha\beta\gamma\delta1234556\alpha\beta\frac{1\sum_b^a}{A^2}\right\}, \tag{2.7a}$$

$$\begin{aligned}\mathcal{M} = & ig_Z^2(4E_1E_2)^{1/2}(l_i^2)^{-1}(g_{\sigma_2}^e)^2\chi_{-\sigma_2}(p_2) \\ & \times[\epsilon_i]_{\sigma_1}\chi_{\sigma_1}(p_1).\end{aligned} \tag{2.7b}$$

If you use a \label{#1} command right after the \begin{mathletters}, then \ref{#1} can be used to reference all the equations in a mathletters environment. For example, the equations in the preceding mathletters environment were Eqs. (2.7).

3. Wide equations

The equation that follows is set in a wide format, i.e., it spans across the full page. The wide format is reserved for long equations that cannot be easily broken into four lines or less:

$$\mathcal{R}^{(\mathrm{d})} = g_{\sigma_2}^e\left(\frac{[\Gamma^Z(3,21)]_{\sigma_1}}{Q_{12}^2-M_W^2}+\frac{[\Gamma^Z(13,2)]_{\sigma_1}}{Q_{13}^2-M_W^2}\right)+x_WQ_e\left(\frac{[\Gamma^\gamma(3,21)]_{\sigma_1}}{Q_{12}^2-M_W^2}+\frac{[\Gamma^\gamma(13,2)]_{\sigma_1}}{Q_{13}^2-M_W^2}\right). \tag{2.8}$$

This is typed so you can see that the output is in wide format. (Since there is no input line between \end{equation} and this paragraph, there is no paragraph indent for this paragraph.) We also have

$$\mathcal{R}^{(f)} = -g^3\delta_{\sigma_1,\sigma_2}\left(\frac{g_{\sigma_2}^eD_Z}{\cos\theta_W}-Q_eD_\gamma\cos\theta_W\right)\left(\frac{[\epsilon_3]_{\sigma_1}}{Q_{12}^2-M_W^2/\xi}\epsilon_1\cdot\epsilon_2+\frac{[\epsilon_2]_{\sigma_1}}{Q_{13}^2-M_W^2/\xi}\epsilon_1\cdot\epsilon_3\right). \tag{2.9}$$

III. CROSS-REFERENCING

REVTEX will automatically number sections, equations, figure captions, and tables. In order to reference them in text, use the \label{#1} and \ref{#1} commands.

The \label{#1} command appears following a section heading; within an equation; or within a figure or table environment, inside of or following the caption. The \ref{#1} command appears in text where citation is to occur. We will refer to the first figure (Fig. 1) here. We can refer to the "late figure" also (Fig. 2).

References to figures: Fig. 1, Fig. 2, Fig. 3, and Fig. 4.

References to tables: Table I, Table II, Table III, Table IV, Table V, and Table VI.

Physical Review style requires that the initial citation of figures or tables be in numerical order in text, so don't cite Fig. 3 until you've cited Fig. 2. See *Style and Notation Guide.*

ACKNOWLEDGMENTS

We wish to acknowledge the support of the author community in using REVTeX, offering suggestions and encouragement, testing new versions, ...

If a section does not have a number (like the Acknowledgments section), use the so-called "star version" of the command. That is, insert a star between the command and its arguments: `\section*{#1}`, `\subsection*{#1}`, etc. For the Acknowledgments section you can also use the command `\acknowledgments` to produce the heading.

APPENDIX A: APPENDIXES

To start the appendixes, you should use the `\appendix` command. This signals that all following section commands refer to appendixes instead of regular sections. Therefore, the `\appendix` command should be used only once—to setup the section commands to act as appendixes. Thereafter normal section commands are used. The heading for a section can be left empty. For example,

```
\appendix
\section{}
```

will produce an appendix heading that says "APPENDIX A" and

```
\appendix
\section{Background}
```

will produce an appendix heading that says "APPENDIX A: BACKGROUND" (note that the colon is set automatically).

If there is only one appendix, then the letter "A" should not appear. This is suppressed by using the star version of the section command (`\section*{#1}`).

APPENDIX B: A LITTLE MORE ON APPENDIXES

Observe that this appendix was started by using

```
\section{A little more on appendixes}
```

Note the equation number in an appendix:

$$E = mc^2. \tag{B1}$$

1. A subsection in an appendix

You can use a subsection or subsubsection in an appendix. Note the numbering: we are now in Appendix B 1.

Note the equation numbers in this appendix, produced with the mathletters environment:

$$E = mc, \tag{B2a}$$

$$E = mc^2, \tag{B2b}$$

$$E \gtrsim mc^3. \tag{B2c}$$

They turn out to be Eqs. (B2a), (B2b), and (B2c).

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[1] A. Smith and B. Doe, J. Chem. Phys. **76**, 4056 (1982).
[2] C. Jones, J. Chem. Phys. **68**, 5298 (1978).
[3] C. Jones and A. Smith, J. Chem. Phys. **72,** 3416 (1980); **73,** 5168 (1980); **72,** 4009 (1980).
[4] Authors are encouraged to use BibTeX and prsty.bst to create their reference list in proper APS style. Instructions can be requested by e-mail (mis@aps.org).

FIG. 1. A figure caption. The figure captions are automatically numbered.

FIG. 2. The "late figure." This figure was inserted when the paper was finished. Since the figures are automatically numbered, no renumbering in text was necessary. All that needed to be done was to type the caption in the proper place and cite the figure in text.

FIG. 3. A figure caption. Figures will be reduced to an appropriate size by the production staff upon receipt.

FIG. 4. A figure caption. The labels you give tables and figures can be descriptive (as that of Fig. 1, which has a `\label{autonum}`) or they can reflect their numerical order, as that of this figure (`\label{fig4}`).

TABLE I. This is a narrow table, which occupies the width of a narrow column. The table captions are automatically numbered. This table shows left-aligned, centered, and right-aligned columns. It also shows one of two possible methods of setting tablenotes (footnotes within tables). In this table the tablenotes are numbered and set automatically. All the author need do is use `\tablenote{#1}` to set a tablenote mark and its text.

One[a]	Two[b]	Three
one	two	three
one	two	three

[a]Note a.
[b]Note b.

TABLE II. This is a table of medium width. This table shows tablenotes where the author has numbered the tablenotes by hand. In this approach, `\tablenotemark[#1]` is used to produce the tablenote mark. `#1` is a numeric value. Each time the same value for `#1` is used, the same mark is produced in the table. After the end of the tabular environment, `\tablenotemark[#1]{#2}` commands are used: `#1` represents the same numbers used in `\tablenotemark[#1]` and `#2` represents the text of the tablenote. Using these two commands will allow the author to number tablenotes by hand. Inspecting the input for this table should clarify any questions.

	r_c (Å)	r_0 (Å)	κr_0		r_c (Å)	r_0 (Å)	κr_0
Cu	0.800	14.10	2.550	Sn[a]	0.680	1.870	3.700
Ag	0.990	15.90	2.710	Pb[b]	0.450	1.930	3.760
Au	1.150	15.90	2.710	Ca[c]	0.750	2.170	3.560
Mg	0.490	17.60	3.200	Sr[d]	0.900	2.370	3.720
Zn	0.300	15.20	2.970	Li[b]	0.380	1.730	2.830
Cd	0.530	17.10	3.160	Na[e]	0.760	2.110	3.120
Hg	0.550	17.80	3.220	K[e]	1.120	2.620	3.480
Al	0.230	15.80	3.240	Rb[c]	1.330	2.800	3.590
Ga	0.310	16.70	3.330	Cs[d]	1.420	3.030	3.740
In	0.460	18.40	3.500	Ba[e]	0.960	2.460	3.780
Tl	0.480	18.90	3.550				

[a]Here's the first, from Ref. [1].
[b]Here's the second.
[c]Here's the third.
[d]Here's the fourth.
[e]And etc.

TABLE III. A wide table. Two alternative occupations of special positions by $KMnCL_3$ ions in the two space groups D^1_{4h} and D^1_{4h}. For a special value of the x and y parameters, a set of special positions may split into two sets of special positions of higher symmetry.

	D^1_{4h}		D^5_{4h}	
Ion	1st alternative	2nd alternative	lst alternative	2nd alternative
K	$(2e)+(2f)$	$(4i)$	$(2c)+(2d)$	$(4f)$
Mn	$(2g)$[a]	$(a)+(b)+(c)+(d)$	$(4e)$	$(2a)+(2b)$
Cl	$(a)+(b)+(c)+(d)$	$(2g)$[a]	$(4e)$[a]	
He	$(8r)$[a]	$(4j)$[a]	$(4g)$[a]	
Ag		$(4k)$[a]		$(4h)$[a]

[a]The z parameter of these positions is $z \sim \frac{1}{4}$.

TABLE IV. Another wide table. Numbers in columns Three–Five have been aligned by using the "d" column specifier. Non-numeric entries (those entries without a ".") are centered in "d" columns.

One	Two	Three	Four	Five
one	two	three	four	five
He	2	2.77234	45672	0.69
C[a]	C[b]	12537.64	37.66345	86.37

[a]Some tables require footnotes.
[b]Some tables need more than one footnote.

TABLE V. A “late table.” This table was added after most of the paper had been completed. Since the tables are automatically numbered, no renumbering in text was necessary. This table was added to show the use of the the “d” column and the @ specifier for lining things up. The “d” column is useful for simpler columns of numerical data, but it may be necessary to use multiple columns and the @ specifier for more complex alignments.

Align by .	Multiple alignments	
23.890 12	23.890 12	± 0.002
12 323	123 223	± 344
0.834 390 12	80.80	± 45.3416

TABLE VI. The Poisson ratio defined as the ratio of lateral contraction to longitudinal expansion for uniaxial stress. Experimental values are given for comparison.

	σ			σ	
	Predicted	Observed[a]		Predicted	Observed[a]
Cu	0.48	0.36	Al	0.47	0.33
Ag	0.48	0.37	Tl	0.47	0.35
Au	0.48	0.36	Sn	0.46	0.33
Mg	0.47	0.35	Pb	0.46	0.40–0.45
Zn	0.47	0.25	Pb	0.49	0.43
			K	0.49	0.44