

STYLE GUIDE  
for  
*PLANCK* PAPERS

C. R. LAWRENCE, T. J. PEARSON, DOUGLAS SCOTT,  
L. SPENCER, A. ZONCA

2013 FEBRUARY 6



## TABLE OF CONTENTS

1	PURPOSE	1
2	HOW TO REFER TO THE <i>PLANCK</i> PROJECT	1
3	HOW TO REFER TO <i>PLANCK</i> CATALOGUES AND CRYOCOOLERS	1
4	DATES	1
5	ACRONYMS, AND ACTIVE LINKS	2
6	TITLE	2
7	ABSTRACT	2
8	CORRESPONDING AUTHOR AND ACKNOWLEDGMENTS	2
9	UNITS	3
10	NOTATION	4
11	PUNCTUATION, ABBREVIATIONS, AND CAPITALIZATION	4
12	CONTENT	5
13	USE OF THE ENGLISH LANGUAGE	5
14	La <sub>T</sub> <sub>E</sub> X AND T <sub>E</sub> X; TYPESETTING MATHEMATICS	8
15	REFERENCES	10
16	FIGURES	10
	16.1 From the A&A Author's Guide	10
	16.2 Requirements for line plots	11
	16.3 Examples of line plots	12
	16.4 Requirements for all-sky maps	13
	16.5 Requirements for figures with shading	13
	16.6 Additional points	13
17	Fixes for two annoying La <sub>T</sub> <sub>E</sub> X problems	16
18	TABLES	16
	18.1 Tutorial on Tables	18
	18.2 Columns	19
	18.3 Centring, etc. in columns	19
	18.4 Rules	20
	18.5 Space between columns	20
	18.6 Space between rows	22
	18.7 How to override the template for a particular entry	23
	18.8 More on rules	23
	18.9 Centring a table	24
	18.10 How to make a table of a specified width	24

18.11	How to run something across more than one column	24
18.12	Leaders: filling up a column with rules or dots	25
18.13	How to line up columns of numbers	26
18.14	Adding footnotes to a table	28
18.15	Paragraphs as table entries	30

## 1 PURPOSE

This Style Guide is intended to help authors of *Planck*-related papers prepare high-quality manuscripts in a uniform style. It supplements the instructions to authors provided by the Astronomy & Astrophysics Author’s guide

[http://www.aanda.org/doc\\_journal/instructions/aa\\_instructions.pdf](http://www.aanda.org/doc_journal/instructions/aa_instructions.pdf)

and implemented in the A&A document class file `aa.cls`, available from the *Planck* Publication Management (PPM) web page and from <http://www.aanda.org/>. LaTeX commands specific to *Planck* papers are found in `Planck.tex`, available on the PPM web page. To use, insert the line `\input Planck.tex` after the initial `\documentclass` command in your input file. A&A also has a useful English usage guide, available at

[http://www.aanda.org/doc\\_journal/instructions/aa\\_english\\_guide.pdf](http://www.aanda.org/doc_journal/instructions/aa_english_guide.pdf).

Both can be found under “Author Information” at <http://www.aanda.org/>.

## 2 HOW TO REFER TO THE *PLANCK* PROJECT

Refer to “the *Planck* project,” “the *Planck* spacecraft,” or “*Planck*.” The name should be italicized (as are all spacecraft names, including *WMAP* and *Herschel*; but italics are not used for “Planck constant,” “Max Planck,” or the names of instruments such as DIRBE, SPIRE, HFI or LFI). This can be done in all font environments (e.g., normal text, bold titles, or section headings) with `\textit{Planck}`. `\Planck` is so defined in `Planck.tex` for convenience. Additionally “Planck” is not in italics in references that include the phrase “Planck Collaboration.”

The possessive version of *Planck* is “*Planck*’s,” written `\Planck’s`. Note that the apostrophe and the “s” are roman, and that the italic correction is built into the definition of `\Planck`, so you don’t have to worry about spacing.

## 3 HOW TO REFER TO *PLANCK* CATALOGUES AND CRYOCOOLERS

Use “*Planck* Early Release Compact Source Catalogue (ERCSC)” at the first reference to it in the text, and “ERCSC” thereafter. The ERCSC contains the Early Sunyaev-Zeldovich (ESZ) catalogue and the Early Cold Cores (ECC) catalogue, which should be referred to similarly. Don’t worry that the expression “the ESZ” seems to be missing a noun.

Similarly, use “*Planck* Catalogue of Compact Sources (PCCS)” and “*Planck* Cluster Catalogue (PCC)” for the catalogues to be released in March 2013. Names for the second and likely final versions of the catalogues to be released in 2014 are not yet settled. When they are, they’ll be added here.

The *Planck* cryocoolers should be referred to as the “sorption cooler,” the “<sup>4</sup>He-JT cooler,” and the “dilution cooler.” The command `\HeJT`, defined in `Planck.tex`, produces <sup>4</sup>He-JT for convenience.

## 4 DATES

A&A is flexible about the format for dates, “as long as you remain consistent.” A&A itself writes *Received* and *Accepted* dates in “day month year” format, e.g., 11 January 2011. We will adopt that as the standard for dates in the *Planck* papers.

There are two exceptions. The English-Guide (§1 above) says “When the date is an integral part of the event’s name, the use of the IAU format is recommended but not mandatory (for example, ‘the 2003 January 17 CME event’). Dates included in tables should be in IAU abridged format (for example, 2003 Jul 4).”

## 5 ACRONYMS, AND ACTIVE LINKS

Use acronyms where appropriate, but define them when they are first used (in both abstract and main text). If they are used only once or twice, write them out in full. Do not use an acronym if it makes the sentence harder to read aloud. If you use many acronyms, include a list of acronyms at the end of the paper.

To include active links in the output .pdf file, include `\usepackage{hyperref}` at the beginning of the LaTeX file and use `\url{}`, e.g., `\footnote{\url{http://www.asdc.asi.it/fermibs1/}}`.

## 6 TITLE

The title of *Planck* general and special “early” papers is of the form “*Planck* early results. XX. Specific title of paper,” where XX is an assigned sequence number. Note the punctuation and capitalization. In general, only “*Planck*” and the first word of the specific title are capitalized; however, anything that would be capitalized in the middle of a text sentence should also be capitalized. Do not use abbreviations and acronyms, except those that are in general use. Try to avoid use of Greek letters and other special symbols (indexing services often cannot reproduce these accurately). See §2 above about the italics.

A similar scheme is used for *Planck* intermediate papers, e.g., “*Planck* intermediate results. XX. Specific title of paper” and cosmology and product papers, e.g., “*Planck* first data release. XX. Specific title of paper.”

The title for the cosmology and product papers will be decided soon.

## 7 ABSTRACT

The abstract is a summary of the paper, not part of the paper. Do not include anything in the abstract that is not also included (usually at greater length) in the text of the paper. Do not treat the abstract as an introduction to the paper; the paper should make sense without the abstract. Do not include references in the abstract.

All significant or important conclusions of the paper should be contained in the abstract, including numerical results (with uncertainties or confidence levels) when appropriate. Avoid vague statements such as “We discuss the implications of the observations.” It is usually best to write an abstract in an impersonal style (avoiding “I” “and “we”).

Use the “traditional” abstract style (not the A&A “structured” abstract) specified with `\documentclass[traditabstract]{aa}` on the first line of the input file. The “structure” of the structured abstract is a reasonable guide that authors may like to follow. We just don’t want those amateurish-looking headings!

## 8 CORRESPONDING AUTHOR AND ACKNOWLEDGMENTS

The corresponding author, the single point of contact with A&A, is “generated” during the submission process, and not specified in the paper itself. For that reason, submission must be performed by the corresponding author. Nonetheless, so that we can keep track of who is handling these secretarial duties for all the papers, insert `\thanks{Corresponding author: J. J. Doe \url{<email.address>}}` immediately after the corresponding author’s name and footnote reference in the `Proj_Ref_n_n_authors_and_institutes.tex` file. (See §5 for the use of `\url{}`).

Every paper should include the following footnote immediately after the first instance of “*Planck*” in the text. Don’t try to footnote the title!

`\footnote{\Planck\ (\url{http://www.esa.int/Planck})` is a project of the European Space Agency (ESA) with instruments provided by two scientific consortia funded by ESA member states (in particular the lead countries France and Italy), with contributions from NASA

(USA) and telescope reflectors provided by a collaboration between ESA and a scientific consortium led and funded by Denmark.}

A standard acknowledgment in both long and short forms was provided for use at the end of the early and intermediate papers, and will be used also for the cosmology and product papers. Additional acknowledgments will be appropriate for individual papers, for example, the use of the `Healpix` package, or data from another instrument or mission such as *XMM*, *Herschel*, 2MASS, SDSS, etc.

## 9 UNITS

1) Units should *always* be in a roman font, *never* in italics!! E.g.,  $g = 9.8 \text{ m s}^{-2}$  is correct, but  $g = 9.8 \textit{ m s}^{-2}$  is **wrong**. It may take extra work to keep the units out of math mode, or control the font inside math mode, but it must be done! Commands for many common units are defined in `Planck.tex` so that they can be used in or out of math mode, producing the correct (roman) fonts in either case.

2) Units should *always* be singular, *never* plural. E.g., “erg,” not “ergs.” (But see #3, next.)

3) When units are written out in text (as they should be when used without a numerical value), they are not capitalized even if formed from a proper name, and the plural is always formed by adding an “s.” For example, “the flux density values were converted to janskys,” not “janskies.”

4) Use SI units. Avoid as far as possible non-SI units (including ergs, inches, cm, cu.ft.). Use the correct SI abbreviations, e.g., “kV” not “KV,” “GHz” not “Ghz,”

5) Microns as a unit of length should be written “ $\mu\text{m}$ ,” defined in `Planck.tex` as both `\micron` and `\microns` (so you don’t have to remember).

6) Units should be separated from numbers (and from other units) by a “thinspace,” available in `LaTeX` in both math and non-math modes as “`\,`” For example,  $H_0 = 72 \text{ km s}^{-1} \text{ Mpc}^{-1}$  is obtained by `\$H_0 = 72\$,km\,s^{-1}\$,Mpc\^{-1}\$`. (In `Planck.tex`, `\kmsMpc` is defined to produce proper units either inside or outside of math mode.)

7) Avoid units in subscripts — it’s better to define an appropriate notation at the first use, e.g., “the flux density at 70 GHz,  $S_{70}$  , . . .”

8) Write  $\text{km s}^{-1}$ , *not* km/s.

9) Write “s,” *not* “sec.”

10) In figure labels and tables, enclose units in brackets, e.g., “Time [s],” “Frequency [Hz],” “Sensitivity [ $\mu\text{K s}^{1/2}$ ].” A&A apparently prefer to have units in round brackets, e.g., “Time (s).” However, we succeeded with some Early Papers and will persevere. The less used square brackets are more distinctive, and if used consistently make it easy to distinguish units from other quantities. See § 18.11 for an example of how units should be specified in a table (whatever kind of brackets are used).

11) Degrees, arcminutes, and arcseconds are generally typeset as symbols,  $^\circ$ ,  $'$ ,  $''$ , which can be obtained with `\deg`, `\arcmin`, and `\arcsec`, defined in `Planck.tex`. Non-integer values should place the symbol over the decimal point. Spacing is a bit tricky because of the different shapes of the digits 0–9, but the commands `\pdeg`, `\parcm`, and `\parcs` in `Planck.tex` work well. For example, `2\pdeg8`, `2\parcm8`, and `2\parcs8` produce  $2^\circ 8$ ,  $2' 8$ , and  $2'' 8$ , respectively. All of these commands work in or out of math mode. A&A provides `\degr`, `\arcmin`, `\arcsec`, `\fdg`, `\farcm`, and `\farcs`, for the same purpose, but the digits and angle symbols are not spaced as well.

12) Use “deg<sup>2</sup>” rather than “square degrees.”

13) If a cosmological model is required, use the fiducial *Planck* model found at

<http://hfilfi.planck.fr/index.php/Site/Commonalities>

14) For the temperature of the CMB, use  $T_0 = 2.7255 \pm 0.0006$  (Fixsen 2009). That’s the rounded version of what Fixsen says in the paper for the fit to FIRAS plus other experiments.

## 10 NOTATION

- 1) The acronym for cosmic microwave background is “CMB,” not “CBR,” “CMBR” or anything else.
- 2) Use  $\ell$ , obtained with `\ell`, for the multipole index only. Galactic longitude is written “ $l$ ,” obtained with `\ell`.
- 3) The plural of  $C_\ell$  (`C_\ell`) should be written  $C_{\ell s}$  (`C_\ell s`), *not*  $C_\ell$ ’s (`C_\ell s`).
- 4) The symbol for flux density is  $S_\nu$  (obtained with `S_\nu`), *not*  $f_\nu$  or anything else. *Planck* measures flux density, *not* “flux,” and the use of “flux” as shorthand for “flux density” is **never** allowed, as “flux” is a physically distinct quantity.
- 5) “E” and “B” should be in a roman font in sub- and superscripts, but math italics otherwise. Same for  $Q$  and  $U$ .
- 6) Use the percent symbol “%” rather than “per cent” or “percent” following a number, with a thin space (`\,`) before the % sign (e.g., 73%). But in a phrase such as “a few percent” write out the words.
- 7) Use `\Msolar` and `\Lsolar` for  $M_\odot$  and  $L_\odot$ .
- 8) Write CO (or similar) transitions as “CO  $J=1\rightarrow 0$ ”, obtained with `CO J=1\rightarrow 0`. (Setting “=1” in text mode bypasses the normal math mode spacing of the equals sign, which is too wide for this situation.) If there are many instances, abbreviation to “CO(1 $\rightarrow$ 0)” after the first instance is all right.

## 11 PUNCTUATION, ABBREVIATIONS, AND CAPITALIZATION

- 1) The abbreviations “i.e.” and “e.g.” should be in roman font and should always be followed by a comma, e.g., “i.e., something.” The A&A Author’s Guide provides no explicit instruction on this point, and is itself inconsistent in its use of a following comma. For uniformity, we will adopt use of the comma. The question of capitalization is irrelevant, because “i.e.” and “e.g.” should not be used at the beginning of a sentence.
- 2) *A&A* uses the “serial comma,” i.e., a comma precedes the “and” before the final item in a list of three or more, e.g., “chocolate, strawberry, and vanilla.”
- 3) According to the A&A Author’s Guide, “The following expressions should always be abbreviated unless they appear at the beginning of a sentence (i.e., Sect., Sects., Fig., Figs., Col., Cols.). Table is never abbreviated.”
- 4) The IAU formally recommends that the initial letters of the names of individual astronomical objects should be printed as capitals (see the IAU Style Manual, *Trans. Int. Astron. Union*, vol. 20B, 1989, Chapt. 8, p. S30); e.g., Earth, Sun, Moon, etc. “The Earth’s equator” and “Earth is a planet in the Solar System” are examples of correct spelling according to these rules.
- 5) “Zeldovich” should be written without the apostrophe in the middle. In general, names that are normally not written in Latin characters should be transliterated following the preference of the owner of the name, as far as possible.
- 6) Capitalize “Galactic” when referring to the Milky Way, e.g., “Galactic plane.”
- 7) Software program names should be set in the fixed-width “tt” font, e.g., `\tt MyProgram`.
- 8) The abbreviation of declination is “Dec,” not “DEC” or “Dec.” The abbreviation of right ascension is “RA,” not “R.A.”

9) The OED capitalizes “Gaussian.” We will adopt that as the *Planck* convention.

## 12 CONTENT

1) A common mistake is to include too much background material in the introduction. Journal articles are not review articles. Cite all closely-related papers and any papers yours depends on, but don’t review the whole history of the subject.

2) There will be many *Planck* papers and we will fatigue readers if we reproduce the same description of the instruments in every one. Refer (once) to the relevant instrument-description papers, and summarize as briefly as possible any characteristics of the instrument that the reader needs to know to understand the present paper.

3) The concluding section of the paper should be precisely that: a concise statement of the conclusions. It is not necessary to repeat material from the abstract or introduction.

4) New material should not be introduced in a section headed “Conclusions.” Use a “Discussion” section for that.

5) Strive for conciseness; avoid unnecessary verbiage.

## 13 USE OF THE ENGLISH LANGUAGE

Use standard British words and spellings. Examples follow. The first five highlight differences between standard British and European usage. To repeat, use standard British usage!

1) *Performance* as it will be used in *Planck* papers is a singular noun. For example, “The **performance** of *Planck*” is correct. “The **performances** of *Planck*” is not.

“Performance” is a noun with two related meanings. One type of “performance” is quantized and can be counted, the other is continuous and can be measured. Example 1: “The orchestra will give one performance on Monday and two **performances** on Thursday.” Example 2: “The **performance** of the *Planck* telescope at cryogenic temperatures was difficult to measure.” The key distinction is that the quantized, countable type of performance has number, i.e., it is singular or plural depending on the count. But the continuous, measurable version, has no number. It *never* has an “s” at the end. The countable type of “performance” is unlikely in the *Planck* papers. Therefore a global search and replace of “performances” with “performance” will safely eliminate misuse.

2) *Noise* as it will be used in *Planck* papers is also measurable and continuous, and therefore a singular noun. “The **noises** of *Planck*” is not correct.

3) *Emission*, as in “bright diffuse emission,” and as it will most likely be used in the *Planck* papers, is also singular. “Bright diffuse **emissions**” is not correct.

4) *Allow* is a transitive verb, and requires an object.

“The accuracy of this model **allows us** to remove the effects of thermal fluctuations from the data directly” is correct.

“The accuracy of this model **allows removal of** the effects of thermal fluctuations from the data directly” is correct.

“The accuracy of this model **allows to remove** the effects of thermal fluctuations from the data directly” is incorrect, because **to remove** is not an object.

5) *Permit* is also a transitive verb. See § 13.4.

6) One of the weirdnesses of English usage, that sometimes verbs are followed by an infinitive while at other times they are followed by a gerund, is explained quite well at

<http://www.englishpage.com/gerunds/index.htm>.

7) “*Modelisation*” (or “modelization”) is not in the Oxford English Dictionary (OED, the ultimate authority for standard English), at least not yet. Don’t use it. “Model” or “modelling” are probably what you want.

8) All sentences must have a verb; subject and verb must match in number.

9) *That* and *which* should be used as explained in this paragraph from the A&A English Guide:

“That” (not in phrases such as “enough . . . that . . .”) is never preceded by a comma, because it introduces a restrictive clause. If tempted to use a comma there, then check that “which” is not more appropriate (=non-restrictive). That “that” is already used for so many functions makes it all the more necessary to keep to the conventions. Even though standard English allows “which” to be used for the restrictive dependent clause, scientific articles prefer to keep the difference to the non-restrictive even clearer by using only “that” without comma or “which” with a comma when nonrestrictive. Example: “Both metallicity components appear to have a common origin, which is different from that of the dark-matter halo.” vs. “Both metallicity components appear to have a common origin that is different from that of the dark-matter halo.”

If that doesn’t all make sense, concentrate on the example, and remember that no comma should precede “that,” but a comma should always precede “which.”

10) A&A itself is flexible on spelling. Their basic principle is “to ask for consistency within an article, whether in the punctuation, capitalization, spelling, or abbreviations.” Our choice for the *Planck* papers is to follow common British conventions. Table 1 gives examples of differences. *Planck* will adopt the versions in red.

Note one change from previous versions of the Style Guide. We now specify “polarize” instead of “polarise.” Although both “-ize” and “-ise” are used in British English, the OED prefers “-ize.” Although “polarise” appears a few times in the Early and Intermediate Results papers, the big use of “polarize” and related nouns will come in the future, so it seems worth a minor inconsistency now in order to follow the OED more closely in the future.

11) “Between A and B,” “from A to B,” or “in the range A–B” are OK. “Between A to B,” “from A–B,” and “between A–B” are not.

12) For the plural of “halo” write “halos,” not “haloes.”

13) Use of the word “significant” when *not* discussing statistical significance can be confusing. Be careful, or don’t do it.

14) It is better to use the term “uncertainties” than “errors.” When giving uncertainties, state the confidence interval and its probability content, e.g., 68.3% or 99.5%. Avoid using, e.g.,  $2\sigma$  or  $3\sigma$ , especially if the underlying distribution is non-Gaussian or asymmetric. An uncertainty introduced by “ $\pm$ ” (e.g.,  $x \pm y$ ) is taken to be a symmetric 68.3% confidence interval ( $[x - y, x + y]$ ) unless otherwise stated. Upper limits need careful explanation.

15) After introducing an acronym, use only the acronym.

16) Use active voice when suitable, particularly when necessary for correct syntax (e.g., “To address this possibility, we constructed a  $\lambda$  Zap library. . .,” not “To address this possibility, a  $\lambda$  Zap library was constructed. . .”). But see § 7 on abstracts.

17) Write concisely (e.g., “even though,” not “in spite of the fact that”).

18) When two or more similar terms are used throughout text, either make the usage consistent or clarify the distinction(s), as appropriate.

19) Avoid using terms such as “novel,” “first,” or “our laboratory has pioneered. . .” to describe the present work. The novelty should be apparent without being highlighted. Do not mention your own work in progress within the text (cross reference the appropriate *Planck* paper).

20) “A and B” or variants such as “A together with B” are plural subjects and need a plural verb, e.g., “A and B are. . .”

21) Avoid using “systematics” by itself. Use “systematic errors” or “systematic effects.”

22) The names of things don’t usually need to be capitalized, e.g., “orthomode transducer,” not “Orthomode Transducer,” even when defining an acronym, e.g., “active galactic nucleus (AGN),” not “Active Galactic Nucleus (AGN).”

23) “Time-ordered data” should be hyphenated. “Sidelobe,” “nonlinear,” and “mapmaking” should not. The rules of hyphenation can be daunting because there are so many cases (see,

**Table 1. BRITISH AND AMERICAN SPELLING CONVENTIONS<sup>a</sup>**

	British	American
<b>Words ending in -re</b> British English words that end in <i>-re</i> often end in <i>-er</i> in American English.	centre (centred, centring) fibre litre metre theatre	center (centered, centering) fiber liter meter theater <b>or</b> theatre
<b>Words ending in -our</b> British English words ending in <i>-our</i> usually end in <i>-or</i> in American English.	colour flavour humour labour neighbour	color flavor humor labor neighbor
<b>Words ending in -ize or -ise</b> Verbs in British English that can be spelled with either <i>-ize</i> or <i>-ise</i> at the end are always spelled with <i>-ize</i> at the end in American English.  Related nouns follow the same convention.	apodize <b>or</b> apodise apologize <b>or</b> apologise ionize <b>or</b> ionise normalize <b>or</b> normalise organize <b>or</b> organise polarize <b>or</b> polarise recognize <b>or</b> recognise  apodization <b>or</b> apodisation ionization <b>or</b> ionisation normalization <b>or</b> normalisation polarization <b>or</b> polarisation	apodize apologize ionize normalize organize polarize recognize  apodization ionization normalization polarization
<b>Words ending in -yse</b> Verbs in British English that end in <i>-yse</i> are always spelled <i>-yze</i> in American English.	analyse	analyze
<b>Words ending in a vowel plus l</b> In British spelling, verbs ending in a vowel plus <i>l</i> double the <i>l</i> when adding endings that begin with a vowel. In American English, the <i>l</i> is not doubled.	travel travelled travelling traveller  fuel fuelled fuelling	travel traveled traveling traveler  fuel fueled fueling
<b>Nouns ending with -ence</b> Some nouns that end with <i>-ence</i> in British English are spelled <i>-ense</i> in American English.	defence licence offence pretence	defense license offense pretense
<b>Nouns ending with -ogue</b> Some nouns that end with <i>-ogue</i> in British English end with either <i>-og</i> or <i>-ogue</i> in American English.  The distinctions here are not hard and fast. The spelling <i>analogue</i> is acceptable but not very common in American English; <i>catalog</i> has become the US norm, but <i>catalogue</i> is not uncommon; <i>dialogue</i> is still preferred over <i>dialog</i> .	analogue catalogue dialogue	analog <b>or</b> analogue catalog <b>or</b> catalogue dialog <b>or</b> dialogue
<b>Other examples</b> A few more British versions that should be used in <i>Planck</i> papers.	artefact grey formulae towards <b>or</b> toward	artifact gray formulas toward <b>or</b> towards

<sup>a</sup> Mostly from <http://oxforddictionaries.com/words/british-and-american-spelling>

e.g., [http://en.wikipedia.org/wiki/English\\_compound](http://en.wikipedia.org/wiki/English_compound)), but most of them involve nouns used as adjectives in multiple combinations, affecting a relatively small number of cases. If in doubt, don't hyphenate.

24) The ampersand, “&,” is not acceptable in a sentence. Write, e.g., “using the 100 and 143 GHz channels,” not “using the 100 & 143 GHz channels.”

25) Spell out numbers up to and including ten; use digits above except at the beginning of a sentence.<sup>†</sup> However, numbers with units are always written with digits, including things like “5 $\sigma$ .”

26) Use “reliability” rather than “purity” for the probability that a source is real.

## 14 **LaTeX AND T<sub>E</sub>X; TYPESETTING MATHEMATICS**

1) Always indicate the start of a new paragraph by a blank line in the T<sub>E</sub>X code. Special layout commands such as `\vskip` and `\noindent` are not generally required; the journal-supplied LaTeX styles will take care of layout.

2) *Quotation marks*. Use “‘’” and “’’,” not the double-quote character found on English keyboards above the apostrophe. A comma or period goes inside the quotation marks, not outside, e.g., “*Planck* is a great mission.”

3) *Dashes*. Distinguish hyphen (-), produced with a single dash (-) and used for compound words (e.g., “free-free”) and word breaks; en-dash (–), produced with two dashes (--) and used for a range; em-dash (—), produced with three dashes (---) and used (infrequently) as a punctuation mark; and minus (−), produced by a dash in math mode ( $\$-\$$ ). **Note that minus signs can only be typeset in math mode (including in tables!). Conversely, hyphens, en dashes, and em dashes cannot be typeset in math mode.** Always set the complete mathematical expression in math-mode, e.g., “ $\$-17.2\pm 0.3\$$ ” rather than “ $\$-\$17.2\pm 0.3\$$ ” in order to get correct spacing. The former gives  $-17.2 \pm 0.3$ , while the latter gives  $-17.2 \pm 0.3$ .

4) *Commas*. To avoid adding extra space in math mode, a comma may be put in brackets. Compare the result of `\$a{,}b\$` ( $a,b$ ), with the result of `\$a,b\$` ( $a, b$ ).

5) *More commas*. In English, a comma is never used for a decimal point.

6) *Symbols*. Use italic (the default in math mode) for all single-letter symbols that represent variables (i.e., quantities that have a numerical value). For example, use  $\$H_0\$$ , not  $\$H_0\$$  ( $H_0$ , not  $H_0$ ). Similarly, the redshift  $z$  should always be in italics, including in such expressions as “high- $z$ ” (obtained with `\$high-\$z\$`).

7) *Mixing symbols and words*. Use relational symbols ( $=$ ,  $<$ ,  $\simeq$ , etc.) in equations, not in text. Write an equation, or use words. For example, write “frequencies of 30 GHz and above,” rather than “frequencies  $\geq$  30 GHz.” Similarly, write “an average factor of about 1.8,” rather than “an average factor of  $\simeq$  1.8.” Better yet (see 14.11 below), write “an average factor of 1.8,” leaving out the meaningless “about.”

8) Use roman fonts for tags or labels in subscripts, e.g.,  $n_e$ ,  $z_{\text{rec}}$ , and for multi-letter operators. This avoids ambiguities by always explicitly distinguishing variables from abbreviations. For example,  $z_i$  (obtained with `\$z_i\$`) might be the  $i$ th redshift under consideration, while  $z_i$  (obtained with `\$z_{\text{rm } i}\$`) might be defined as the reionization redshift.

Particle physicists sometimes write particle names in italics, e.g.,  $n_e$  instead of  $n_e$ . We suspect they are just being lazy. But some typesetters always use italics for a single-letter symbol, perhaps because they don't know if it is a variable or a tag. The important thing is that multi-letter symbols should be in roman to avoid the confusion of whether “*em*” is a single symbol or “*e*” times “*m*.”

<sup>†</sup> And don't ask about the pathological case of ranges like “seven to 11!”

9) Always use the standard TeX commands for operators, `\log`, `\cos`, `\sin`, `\ln`, etc. Right: `\log{S}`. Wrong: `log(SS)`, or `{\rm log} S`, or anything else. Using the TeX commands will also preclude capitalization of these operators, which is almost always wrong.

10) A&A recommends typesetting vectors and tensors with `\vec{A}` and `\tens{B}`. These produce bold italic and upright sans-serif characters, i.e., **A** and **B**, respectively.

11) Use “about,” “around,” and “approximately” in preference to “ $\sim$ ,” but use all sparingly! They are often almost meaningless, and their use is a bad and annoying habit on the part of the writer. If the uncertainty in a numerical value cannot be represented reasonably by the number of significant digits, specify the uncertainty explicitly. A special microlevel of hell is reserved for those who write “about  $\sim$ .”

12) Don’t use “ $\sim$ ” when you mean “ $\propto$ .”

13) Don’t use both “ $\simeq$ ” (`\simeq`) and “ $\approx$ ” (`\approx`) in the same paper unless you explicitly mean something different. If in doubt, use “ $\approx$ .” (And see point #11 above!)

14) *Brackets*. Distinguish angle brackets (`\langle`, `\rangle` producing  $\langle$  and  $\rangle$ ), often used to denote expected value) from the inequality operators  $<$  and  $>$ . Note that “ $<$ ” and “ $>$ ” must never be used outside math mode.

15) *Blank lines*. Don’t leave a blank line after a displayed equation in your input file unless you want a new paragraph. If you want some visual separation between displayed equations and text in your input file, use comment lines, e.g.,

```
Text blah blah blah
```

```
%
```

```
$$E=mc^2,$$
```

```
%
```

```
where $c$ is the speed of light in vacuum.
```

16) *Acronyms*. Try to avoid using an acronym as a variable (e.g., “ $SFR = 10 M_{\odot} \text{yr}^{-1}$ ”), because it is cumbersome. Define a new symbol instead (e.g., “the star formation rate,  $\mathcal{R}$ ”).

17) If you *do* use a multi-letter symbol for a variable, it **must** be in roman, e.g., “ $SFR = 10 M_{\odot} \text{yr}^{-1}$ ,” obtained with “`{\rm SFR} = 10\,\Msolar\,yr\mo`.”

18) *Long equations*. Don’t try to make equations fit by using `\small!`. Instead use `\eqnarray` or something similar to break lines.

19)  $N_{\text{side}}$ . Write “ $N_{\text{side}}$ ” (`\$N_{\rm side}\$`), not “nside.”

20)  $\chi^2$ . Write  $\chi^2$  rather than “chi-square.” Whether giving  $\chi^2$  or reduced  $\chi^2$ , always give  $N_{\text{dof}}$ .

21) *Equation references*. From the A&A Author’s Guide: “All equations that you are referring to with `\ref` must have the corresponding `\label` — please use this mechanism only. Punctuate a displayed equation in the same way as ordinary text.” This means that displayed equations should usually be followed by a comma or period, which generally look better preceded by a thin space `\,`, or a medium space `\>`.

22) *Stokes Parameters*. Since his name was “Stokes,” write “Stokes  $Q$ ,” not “Stoke’s  $Q$ .”

23) *Spacing of exponents*. Now and then, depending on characters, exponents come out too close to the exponentiated symbol, e.g.,  $\nu^{\beta}$ . Space can be added with, e.g., `\nu^{\hbox{\hspace{0.7pt}}\beta}`, giving  $\nu^{\beta}$ . This makes it easy to “tune” the space.

24) *Thousands separator*. A&A doesn’t give a preference for how to write numbers with many digits. The SI standard is to use spaces rather than commas or periods (1,000,000 vs. 1.000.000) to separate thousands. Thin spaces (`\,`) should be used, giving 1000 000. *Never* simply type a space in the input file (10 000), as that would allow a line break in the middle of the number.

25) *Writing “ $\sigma$ ”*. Write `5\sigma` ( $5\sigma$ ) or possibly `5\,\sigma` ( $5\sigma$ ), but never `5-\sigma` ( $5-\sigma$ ), and *especially* never `\$5-\sigma\$` ( $5 - \sigma$ ).

## 15 REFERENCES

1) Use `Planck_bib.bib` in the `aa.cls` environment to ensure correct references to the *Planck* papers. When referring to a *Planck* paper in text, use, e.g., by the `\cite{planck2011-7.2}`, which becomes “by the Planck Collaboration XX (2011).” Note that “the” is not capitalized. For a parenthetical reference, `\citep{Planck2011-7.2}` produces “(Planck Collaboration XX 2011).”

2) Make sure that you use the current version of `Planck_bib.bib`, available at

<http://www.sciops.esa.int/index.php?project=PLANCK&page=Repositories>

3) Note that `ADS+BibTeX` does not always put references in the correct format for the journal. Check them carefully. Take special care with articles in books and conference proceedings: include the title of the book, the editors’ names, the publisher and place of publication, and the page number. `ADS+BibTeX+A&A` also usually omits the arXiv preprint number, which is wrong. This can be fixed by editing the `.bib` file.

4) A useful reference for use of `natbib` can be found at <http://merkel.zoneo.net/Latex/natbib.php>. There are many ways to produce bad combinations of parentheses, commas, semicolons, and years. Beware!

One example is the incorrect `\citep[as studied by][]{FirstPaper, SecondPaper, ThirdPaper}`, which produces “(as studied by FirstPaper; SecondPaper; ThirdPaper).” To obtain the correctly punctuated “(as studied by FirstPaper, SecondPaper, and ThirdPaper)” requires three separate uses of `\citealt`.

## 16 FIGURES

Figures in the cosmology and product papers must satisfy a much higher standard of quality and uniformity than has been the case with the Early Results and Intermediate papers. To meet this high standard, requirements are given for various types of figures. These specifications must be followed in general by all figures. Exceptions can be made, but only for good reason.

Scripts have been developed showing how to drive Python (Andrea Zonca), IDL (Locke Spencer) and PGPlot (Tim Pearson, to be posted soon) to produce figures satisfying the requirements. The companion paper in A&A `LaTeX` format “`Paperplots.tex`” and “`Paperplots.pdf`” show the examples produced by the scripts and how they are incorporated into papers. The scripts themselves are available at

<http://github.com/zonca/paperplots/>

This is a public site for convenience; no *Planck* data are used in the scripts. If you need help, ask Andrea, Locke, or Tim (see <http://www.rssd.esa.int/index.php?project=IDIS&page=people>).

We start with an extract from the A&A Author’s Guide giving the sizes of figures used in the journal and some general guidance for multi-panel figures and captions (legends).

### 16.1 From the A&A Author’s Guide

“Figures submitted to the Journal must be of the highest quality to ensure accuracy and clarity in the final published copy. We urge the author to limit the empty space in and around figures. Artwork should be in sharp focus, with clean, clear numbers and letters and with sharp black lines. Thin lines should be avoided, particularly in figures requiring considerable reduction.

“The author is warned that changes in the size and arrangement of figures can be made by the publisher at the production stage. Because of the bulk of the Journal [we realise this isn’t English!], the production office will reduce most figures to fit a one-column format (88 mm). If necessary, figures may extend across the entire page width (max. 180 mm). Intermediate widths with a side caption are also possible (max. 120 mm). The illustrations should be placed at the top of the column and flush-left according to layout conventions.

“If lettered parts of a figure (e.g., 1a, 1b, 1c, etc.) are referred to in the figure legend, each part of the figure should be labeled with the appropriate letter within the image area. Symbols should be explained in the caption and not in the figure.

“Figure legends should concisely label and explain figures and parts of figures. The first sentence of each figure legend should be a descriptive phrase, omitting the initial article (the, a, an). In multipart figures, the legends should distinguish (a), (b), (c), etc., components of the figure. Note that if parts are identified in the legend as (a), (b), (c), particularly for single figures composed of multiple panels, these letters should be clearly labeled in the figure itself. Otherwise panels should be referred to by position (top right, top left, middle, bottom, etc.). All lines (solid, dashed, dot-dashed, dash-dotted, etc.) and symbols (filled or open circles, squares, triangles, crosses, arrows, etc.) should be explained in the legend. Graphics should not be used in figure legends. The scientific discussion of the table or figure contents should appear in the main body of the article, not in the table title or figure legend.”

## 16.2 Requirements for line plots

1) *Format*. Output should be EPS, PDF, or other vector format compatible with the `LaTeX includegraphics` command.

2) *Size*. A&A prints figures in three widths, 88 mm, 120 mm, and up to 180 mm. **Each figure should be designed for its final size, whether single-column, side caption, or two-column.** Simply rescaling a figure to fit is rarely acceptable because font sizes and line widths will be wrong. Anisotropic scaling of a figure to make it fit is *never* appropriate. Circles become ellipses, and letters are distorted. Figures designed for posters or presentations are unlikely to be appropriate for the journal.

The second paragraph of §16.1 says “The author is warned that . . .the production office will reduce most figures to fit a one-column format (88 mm).” Therefore, design figures for a single column unless there is a strong reason why they must be larger.

3) *Lettering*. There are differing opinions about whether labels look better in a similar font to the paper text or in a sans-serif font. For consistency in *Planck* papers the latter preference has been adopted. Most lettering (including axis labels) should be 8 pt<sup>†</sup> Helvetica, Arial (the Microsoft equivalent of Helvetica), or equivalent sans-serif font, with upper-case letters 1.9–2 mm high *as printed in the journal*. Smaller or larger lettering (6 pt–12 pt) can be used sparingly for exponents, or where it increases clarity. Mathematical symbols should match as closely as possible those used by A&A in text (i.e., LaTeX math fonts).

This is 8-pt Helvetica: Redshift 0, 1, 10, 1000.

This is 10-pt Helvetica: Redshift 0, 1, 10, 1000.

This is 12-pt Helvetica: Redshift 0, 1, 10, 1000.

4) *Line widths for axes, tick marks, etc.* Line widths in the range 0.5–0.8 pt as printed by A&A work well. Lines of width 1 pt are a bit too heavy for the boundary box of a figure, although heavier lines can be used when appropriate for important figure elements to make a clear presentation. In some cases thinner lines may be needed in parts of a figure. Quantization and resolution effects vary from printer to printer; what is seen in test prints may not be exactly what will be seen in A&A.

5) *Axes*. The figure should be enclosed in a frame on all four sides, labelled with tick marks, numerical values, and axis labels. Text labels should not overlap.

<sup>†</sup> In the digital publishing world, 1 pt  $\equiv$  1/72 in = 0.3527 mm.

6) *Orientation of numerical values on axes.* Numerical values should be oriented parallel to the axes. The reason is straightforward. If the numerical values on the vertical axis are perpendicular to the axis, the space they take up horizontally depends on the numbers. The size of the figure box must adjust so that the overall width of the figure is 88, 120, or 170 mm. The figure frame size then depends on the numerical values on the axis. Figure frames that should be exactly the same size will not be. Individual images in composites will vary in size, and be impossible to align. The solution, fortunately, is simple: run the numbers parallel to the axis.

7) *Background grid.* If a grid is needed, it should be drawn with thin lines (0.5pt?) or grey lines, not dashed or dotted lines.

8) *Legends.* A legend within the plot identifying colours and symbols should be included when necessary. Opaque is preferable to transparent, but in any case the legend should not obscure data.

### 16.3 Examples of line plots

Here is a sample figure set in the three sizes used by A&A: single-column width (Fig. 1), 120 mm width (Fig. 2), and two-column width (Fig. 3).

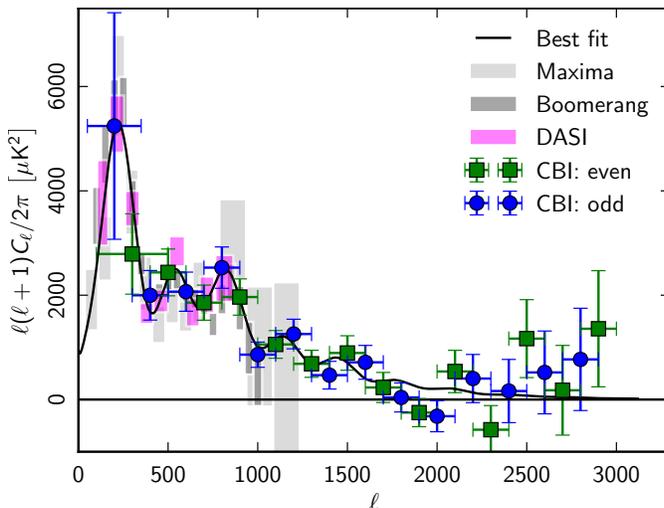


FIG 1.—Comparison of the joint power spectrum estimates from the three CBI mosaics with the measurements from BOOMERANG, DASI, and MAXIMA. The rectangles indicate the 68% confidence intervals on band-power; for BOOMERANG, the solid rectangles indicate the 68% confidence interval for the statistical and sample variance errors, while the hatched rectangles show the amount by which a  $\pm 1\sigma$  error in the beamwidth ( $12'.9 \pm 1'.4$ ) would shift the estimates (all up or all down together). The *black curve* is the joint model (see text).

The required LaTeX commands are

```
\begin{figure} % Single-column figure
\includegraphics[width=\hsize]{filename.eps}
\caption{\fcaption}
\label{fig1col}
\end{figure}

\begin{figure*} % Figure with side caption
\sidecaption
\includegraphics[width=12cm]{filename.eps}
\caption{\fcaption}
\label{figsidecaption}
```

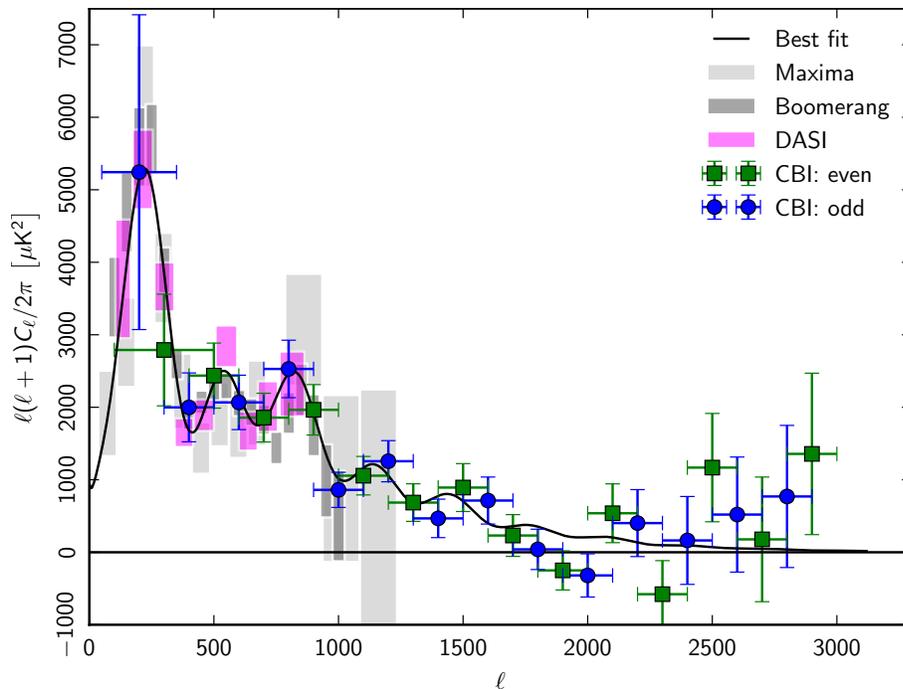


FIG 2.—Figure 120 mm wide, with caption on the side.

\end{figure\*}

```
\begin{figure*} % Two-column figure
\includegraphics[width=17cm]{filename.eps}
\caption{\fcaption}
\label{fig2col}
\end{figure*}
```

## 16.4 Requirements for all-sky maps

See Paperplots.pdf and associated scripts at <http://github.com/zonca/paperplots/>

## 16.5 Requirements for figures with shading

See Paperplots.pdf and associated scripts at <http://github.com/zonca/paperplots/>

## 16.6 Additional points

1) *File formats.* Use graphics software that produces scaleable, vector-graphic output, such as EPS, PDF, or SVG. Do not use bitmap formats (e.g., PNG, JPEG) except for photographs or images without annotation. If an image needs to be annotated, the bitmap should be embedded in a vector format such as PDF. Never convert the annotation to a bitmap format. If it is impossible to use a scalable vector format, then use a non-lossy, high-resolution ( $> 300$  pixels inch $^{-1}$ ) bitmap format such as TIFF. Do not use JPEG: it will blur the annotation.

2) *Bounding Boxes.* If you are working with an EPS or PDF file, make sure that the bounding box is set correctly within the file. The bounding box should be the minimum required to enclose the visible parts of the figure. *But*, if you have several figures that should all be displayed on the same scale, make sure they have identical bounding boxes. *To be added: notes on tools for setting the bounding box.*

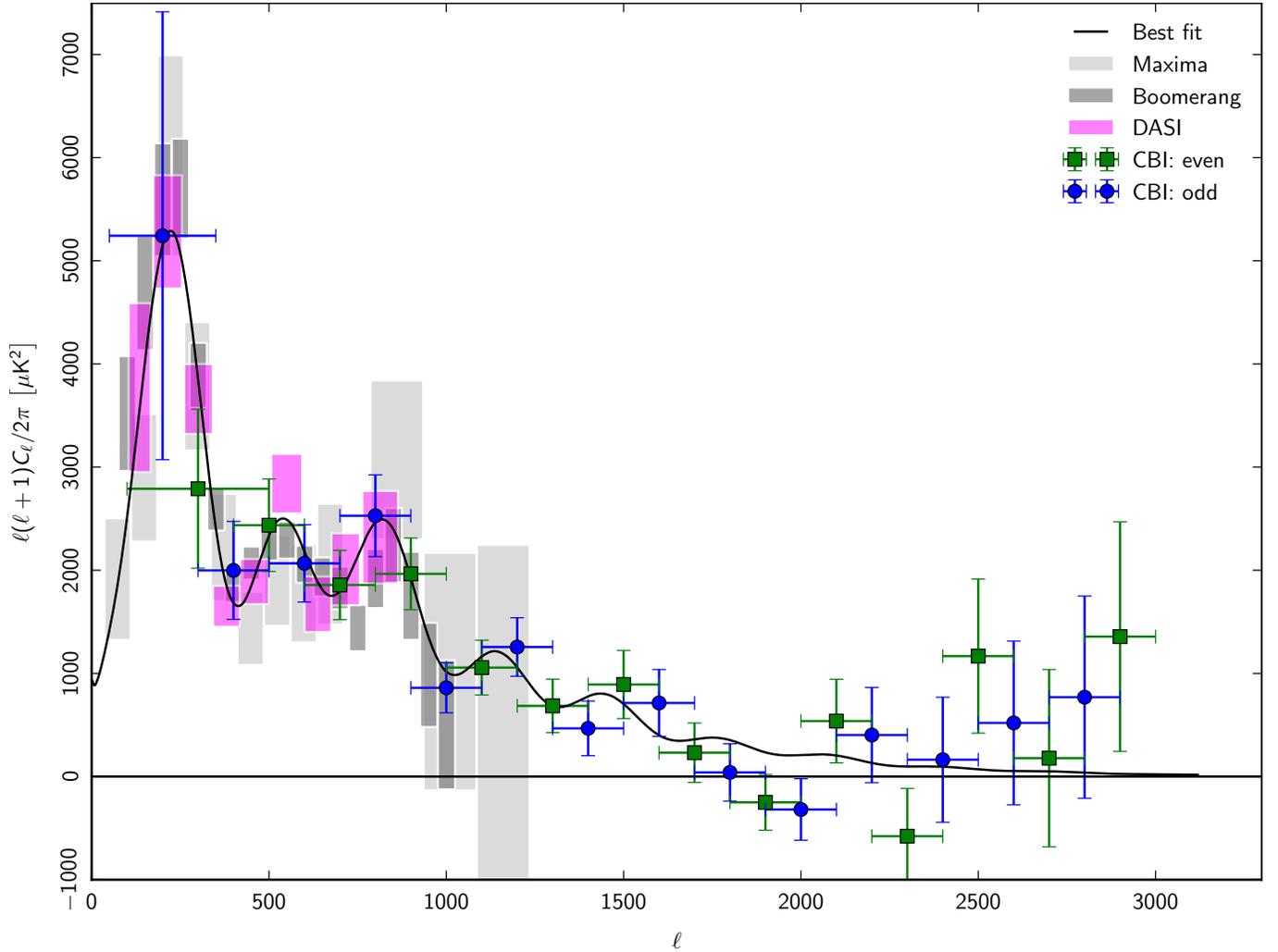


FIG 3.—Comparison of the joint power spectrum estimates from the three CBI mosaics with the measurements from BOOMERANG, DASI, and MAXIMA. The rectangles indicate the 68% confidence intervals on band-power; for BOOMERANG, the solid rectangles indicate the 68% confidence interval for the statistical and sample variance errors, while the hatched rectangles show the amount by which a  $\pm 1\sigma$  error in the beamwidth ( $12'9 \pm 1'4$ ) would shift the estimates (all up or all down together). The *black curve* is the joint model (see text).

3) *More on fonts.* Some graphics software packages use outline or “Hershey” fonts designed for use with pen-plotters. They usually include a sans-serif font that looks similar to Helvetica, but you may need to adjust the line-thickness as well as the character height to get characters of appropriate weight. Typically the line-thickness should be about 1/10 of the character height *to be checked*.

4) *Tick marks and numeric labels.* Have tick marks projecting out of the frame only if it is necessary to make them visible. Use sensible (rational) tick separations. Choose units to get numbers without big exponents. Avoid overlapping labels. At least two, and preferably more than two labels should appear on each axis. Do not use more significant figures than are needed in labels (i.e., 10, not 10.00 or 9.999). It is not necessary to have the same number of decimal places in axis labels. E.g., 0.01, 0.1, 1, 10, 100 is better than 0.01, 0.10, 1.00, 10.00, 100.00. Avoid unnecessary trailing zeros.

Sky images should always have coordinates indicated by a labelled frame or graticule. Use

sexagesimal notation (e.g., h,m,s of RA and d,m,s of Dec) or decimal degrees, but do not mix the two: if you refer to a source RA of 12<sup>h</sup> 30<sup>m</sup> in the text or a table, do not use 187.5 in a figure!

5) *Axis labels*. Label axes with the name or description of the quantity plotted, possibly a symbol, and units if applicable, with the units in square brackets, e.g., Detector temperature  $T_{\text{det}}$  [ $\mu\text{K}$ ], Multipole order  $\ell$ , or Length [mm]. However, if logarithms are involved,  $\text{Log}(\text{length}/\text{mm})$  is preferable. Detector volts [V] is incorrect; it should be Detector reading [V] or possibly Detector voltage [V]. In labels as elsewhere (§ 9.8), use exponents, not fractions in units:  $\text{km s}^{-1}$ , not km/s. Don't use a dot to separate units ( $\text{K km s}^{-1}$ , not  $\text{K.km s}^{-1}$ ). Don't invent units for dimensionless quantities (e.g., say Normalized hit count, not Hit Count [norm.]) Capitalize labels as normal text (first letter and proper names only). Do not use “#” as a synonym for “number.”

6) *Lettering in figures*. Lettering should be in lower-case type, with the first letter capitalized and no full stop. Layering type directly over shaded or textured areas and using reversed type (white lettering on a coloured background) should be avoided where possible.

7) *Colour*. In general, use colour only if it adds significantly to the scientific clarity of the figure. For example, use colour rather than grey and dashed lines if there are many components to be distinguished (more than three or four, say). Always provide a colour bar scale for grey-scale or pseudo-colour images. A graphical legend in the figure, or labelling curves individually, is better than describing elements in the caption (avoid “the green dotted line” etc.; the reader may be viewing a black-and-white copy of the paper, or may be colour blind).

8) *Consistency of style and colour across figures*. Use a uniform style for figures throughout the paper. If a quantity is represented by a red dashed line in one figure, use the same style for it in other related figures.

9) *Captions and titles*. Figures have captions. They *should not* have titles or anything else above the frame of the figure.

10) *Multipanel figures*. For a large set of similar figures (e.g., SEDs for many objects), use a multipanel figure, which can extend over multiple pages if necessary. If there are more than two or three panels, it is usually best to identify each panel internally (e.g., with the object name) rather than in the caption. Avoid phrases like “middle of third row” or “lower right” in the text or caption. Use “(a),” “(b),” ... labels if necessary. In case two panels are referenced in the caption, use “Left:,” “Right:,” “Upper:,” “Lower:,” etc. To achieve this, type, e.g., `\emph{Left}`:. Note that the colon is outside the brackets.

11) *Time axes in days*. Time should be plotted in days rather than operational days. (An operational day is well-defined operationally, but it is not a well-defined time interval.) Time axes labelled with dates are typically quite hard to read, and should be avoided.

12) *SEDs*. SEDs should be plotted with frequency increasing to the right. If you insist on plotting against wavelength, have it increase to the left.

N.B. — This instruction was not followed in some Early Results papers, on the grounds that long-established traditions in sub-fields of astrophysics used different conventions. Time was short, and we didn't insist. However, consistency across *Planck* papers takes precedence. For the Intermediate Results and Cosmology and Product Papers, we will insist.

13) *Mathematical symbols in figures*. Mathematical symbols in figures should match those in the text. Use  $\text{T}_{\text{E}}\text{X}/\text{L}\text{a}\text{T}_{\text{E}}\text{X}$  to make the symbols and paste them into the figure if necessary.

14) *Geometric distortion*. **Do not** scale the height and width of a figure independently to make it fit a spot in a paper. The geometrical distortion of introduced is unacceptable. The consequences are particularly undesirable for Mollweide projections, whose geometrical characteristics are ruined.

## 17 Fixes for two annoying LaTeX problems

1) Sometimes LaTeX puts figures in the wrong order. For example, single-column Fig.10 may appear before double-column Fig.9. The solution is to add

```
\usepackage{fixltx2e}
```

a “LaTeX bug fix package” that fixes this problem and a few others.

2) A&A LaTeX puts double space between institution names at the end of *Planck* papers. To fix this, put `\raggedright` immediately before `\end{document}`.

## 18 TABLES

LaTeX packages, including A&A’s `aa.cls`, try to simplify tables by writing elaborate overlays for `\halign`, a basic TeX command. Unfortunately, they introduce their own complexity at the same time as they reduce flexibility and make it harder to do many things that are important for the readability of tables, things that are simple enough in `\halign`. Overall, it’s easier and better to just use `\halign`.

`\halign` works just fine inside the table environments of `aa.cls`. For a one-column table, use the `\begin{table}...\end{table}` environment. For a two-column table, use the `\begin{table*}...\end{table*}` environment. A template table file is given in `PlanckTable.tex`, which can be found at

<http://www.sciops.esa.int/index.php?project=PLANCK&page=Repositories>

A tutorial in using `\halign` to produce tables for *Planck* is given in § 18.1. Before that, we list some things to do and not to do in tables.

1) Excessive numbers of digits should not be given. Uncertainties should have only *one* digit, unless that digit is a “1,” in which case there can be two digits. This then guides the number of digits required in the value itself. So:  $3 \pm 2$ , not  $3.14 \pm 2.37$ ;  $3.14 \pm 0.17$ , not  $3.14159 \pm 0.17123$ ; etc.

2) In § 14.3 we emphasized that minus signs can only be typeset in math mode, including in tables. One of the most pervasive mistakes in tables in the Early Results papers was use of hyphens instead of minus signs in tables. **Don’t do it!**

3) Footnotes in tables should be identified by italic superscript letters, which can be set with `\tablefootmark{}` and `\tablefoottext{}`.

4) Don’t use check marks in tables as a substitute for “yes” or “Y.” It’s tacky. Better still, don’t use boolean columns in tables at all.

5) Missing values should be indicated by an ellipsis, “...,” obtained most easily with the `\dots` command defined in `Planck.tex`, which works in both text and math modes. Don’t try to produce an ellipsis with periods (full stops). The spacing will be wrong...

6) When entries in a column are to be compared, align the decimal points in both the quantity and the uncertainty (Example 1 in Table 2). When entries in a column are not to be compared, centre the entries and uncertainties in the column. Do not align the decimal point (Example 2 in Table 2). **Note that the style and placement of the table numbers and captions in the examples in this section are not that used by A&A.** The A&A scheme is better suited to two-column output and gives weird-looking results in the single-column format we use here. The `\caption` command from A&A LaTeX used in the `PlanckTable.tex` template file produces results in the standard A&A format.

7) Tables should have a double rule at the top, a single rule between headings and the body of the table, and a rule at the bottom. See § 18.8.

8) The spacing of lines in tables often requires no special attention, at least when there is no complicated structure. However, one case that occurs fairly frequently in *Planck* papers and

**Table 2.**  
DECIMAL POINT ALIGNMENT

30 GHz	
Example 1	
$\Delta T_{30}$ [ $\mu\text{K}$ ] .....	$38.6 \pm 13.2$
$\Delta T_{30}/T$ .....	$1.7 \pm 0.7$
Example 2	
$\Delta T/T$ per pixel ..	$(5.9 \pm 0.6) \times 10^{-3}$
$N_{\text{feeds}}$ .....	$1.2 \pm 0.2$

requires special attention is that of table values with asymmetrical errors (Table 3). Extra space is needed and easily obtained in this example with `\noalign{\vskip 4 pt}` between the lines (see § 18.6).

**Table 3.**  
SPACING WITH ASYMMETRIC ERRORS

Sector	$r_x$ [Mpc]	$D_n$	$M_n$	$D_T$	$M_T$	$D_n \times D_T$	$M_{nT}$	$M_{SZ}$
<b>Bad</b>								
West .....	$1.173^{+0.0003}_{-0.003}$	$2.00^{+0.03}_{-0.03}$	$1.73^{+0.03}_{-0.03}$	$3.0^{+0.7}_{-0.6}$	$2.6^{+0.4}_{-0.4}$	$6.0^{+1.4}_{-1.1}$	$2.3^{+0.2}_{-0.2}$	$1.95^{+0.45}_{-0.02}$
Southeast ...	$0.9778^{+0.0002}_{-0}$	$2.43^{+0.02}_{-0.02}$	$2.10^{+0.01}_{-0.01}$	$1.3^{+1.8}_{-0.6}$	$1.3^{+1.3}_{-1.3}$	$3.1^{+1.6}_{-1.1}$	$1.6^{+0.3}_{-0.1}$	$2.03^{+0.14}_{-0.04}$
<b>Good</b>								
West .....	$1.173^{+0.0003}_{-0.003}$	$2.00^{+0.03}_{-0.03}$	$1.73^{+0.03}_{-0.03}$	$3.0^{+0.7}_{-0.6}$	$2.6^{+0.4}_{-0.4}$	$6.0^{+1.4}_{-1.1}$	$2.3^{+0.2}_{-0.2}$	$1.95^{+0.45}_{-0.02}$
Southeast ...	$0.9778^{+0.0002}_{-0}$	$2.43^{+0.02}_{-0.02}$	$2.10^{+0.01}_{-0.01}$	$1.3^{+1.8}_{-0.6}$	$1.3^{+1.3}_{-1.3}$	$3.1^{+1.6}_{-1.1}$	$1.6^{+0.3}_{-0.1}$	$2.03^{+0.14}_{-0.04}$

9) Blank spaces in the input LaTeX file are often ignored, and adding spaces in table input files can improve the human readability of a table. But there is one case in tables to watch out for. In `\halign`, spaces following ampersands before a table entry are ignored; however, spaces between a table entry and the next ampersand are **not** ignored, and change the spacing of column entries. Consider the following lines, used in Table 4.

```
Quantity&15&4&10&8\cr
Quantity& 15& 4& 10& 8\cr
Quantity& 15 & 4 & 10 & 8 \cr
```

**Table 4.**  
SOME BLANKS MATTER

Quantity ....	15	4	10	8
Quantity ....	15	4	10	8
Quantity ....	15	4	10	8

The first two lines produce identical output, but the second and third lines produce different output. Given the importance of precise alignment of column entries (as discussed above in Table 2), the rule is **no spaces before “&”s and “\cr”s**.

## 18.1 Tutorial on Tables

The best way to construct tables for astronomical journals is to use `\halign`. The best way to use `\halign` for *Planck* tables is the following:

- Insert the file `PlanckTable.tex` into your LaTeX input file to start a table.
- Set up the “template” line. If you haven’t used the `\halign` command before, look through the following examples, find what you want to do, and copy the instructions used to produce it.
- Fill in the table information, following the relevant examples.
- Admire your table. (N.B.: A&A has some strange notions about spacing in tables, whether it’s the space above and below “rules,” between columns, or at the margins. They may change your carefully constructed table in the typesetting process. Nevertheless, experience with the earlier papers shows that they leave the basic structure of the table alone, so it’s worth a good deal of effort to develop a good structure.)
- If you need help, call or email Charles Lawrence (+1 818 642 1784, [charles.lawrence@jpl.nasa.gov](mailto:charles.lawrence@jpl.nasa.gov)).

Here’s what’s in `PlanckTable.tex`.

```

\begin{table}[tmb]    or  % use table for a one-column table
\begin{table*}[tmb]   % use table* for a two-column table
\begingroup          % this + \endgroup at the end keep table things local
\newdimen\tblskip \tblskip=5pt
\caption{Table caption goes here.}
\nointerlineskip
\vskip -3mm
\footnotesize       % good font size for a table, but can be changed
\setbox\tablebox=\vbox{ %
\newdimen\digitwidth % see \S,18.12 for the purpose of the next 10 lines
\setbox0=\hbox{\rm 0}
\digitwidth=\wd0
\catcode'\*=\active
\def*\{\kern\digitwidth}
%
\newdimen\signwidth
\setbox0=\hbox{+}
\signwidth=\wd0
\catcode'\! =\active
\def!\{\kern\signwidth}
%
\halign{              % template goes here.    See examples.
\noalign{\doubleline}
% heading goes here.    See examples.
\noalign{\vskip 3pt\hrule\vskip 5pt}
% table lines go here.    See examples.
\noalign{\vskip 5pt\hrule\vskip 3pt}}
\endPlancktable      or      % for a one-column table; defined in Planck.tex.
\endPlancktablewide  % for a two-column table; defined in Planck.tex.

```

```

\endgroup
\end{table}          or
\end{table*}

```

## 18.2 Columns

Here is a skeleton three-column table:

```

\halign{ & & \cr
apples&bears&yams\cr
oranges&elephants&corn\cr
watermelons&brontosauruses&rutabagas\cr
peaches&llamas&peas\cr
}

```

This produces

```

apples      bears      yams
oranges     elephants  corn
watermelonsbrontosaurusesrutabagas
peaches     llamas     peas

```

The width of each column is the width of the widest entry in that column.

## 18.3 Centring, etc. in columns

To left justify entries in a column, use `#\hfil` as the template (this is the default). To centre entries in a column, use `\hfil#\hfil`. To right justify, use `\hfil#`. Modifying the example in § 18.1,

```

\halign{#\hfil&
        \hfil#\hfil&
        \hfil#\cr
apples&bears&yams\cr
oranges&elephants&corn\cr
watermelons&brontosauruses&rutabagas\cr
peaches&llamas&peas\cr
}

```

produces

```

apples      bears      yams
oranges     elephants  corn
watermelonsbrontosaurusesrutabagas
peaches     llamas     peas

```

Alternatively,

```

\halign{\hfil#&
        \hfil#\hfil&
        #\hfil\cr
apples&bears&yams\cr
oranges&elephants&corn\cr
watermelons&brontosauruses&rutabagas\cr
}

```

```
peaches&llamas&peas\cr
}
```

produces

```
apples bears yams
oranges elephants corn
watermelonsbrontosaurusesarutabagas
peaches llamas peas
```

Notice that the template line in the `\halign` command is broken into separate lines following the ampersands (&). Spaces following an & in the input file are discarded, i.e., they have no effect on the output. As will be seen below, this can also be exploited to line up column entries in the input file for easier reading by humans.

#### 18.4 Rules

Horizontal lines, “rules” in typesetting parlance, set off the top and bottom of tables, and separate headings from table entries. The following example shows how to produce rules, and also how to use the template specification to do a couple of other things.

```
\halign{\it#\hfil&
        \hfil# and mice\hfil&
        \sl\hfil#\cr
\noalign{\hrule}
apples&bears&yams\cr
oranges&elephants&corn\cr
watermelons&brontosaurusesarutabagas\cr
peaches&llamas&peas\cr
\noalign{\hrule}
}
```

<i>apples</i>	bears and mice	<i>yams</i>
<i>oranges</i>	elephants and mice	<i>corn</i>
<i>watermelons</i>	brontosaurusesarutabagas	
<i>peaches</i>	llamas and mice	<i>peas</i>

See § 18.7 for more on rules after headings are introduced.

#### 18.5 Space between columns

In general, space between columns is needed. The best way to do this is with “`tabskip glue`.” `Tabskip glue` is added before the first column, between all columns (in other words, where the ampersands are), and after the last column. If you haven’t specified `\tabskip= . . .` then the default value of zero is used. The value of `tabskip` in effect when  $\text{T}_{\text{E}}\text{X}$  reads the `{` following `\halign` will be used before the first column (i.e., at the left edge of the table); the value in effect when  $\text{T}_{\text{E}}\text{X}$  reads the `&` after the template for the first column will be used between the first and second columns, and so on. The value of `tabskip` in effect when  $\text{T}_{\text{E}}\text{X}$  reads the `\cr` after the template for the last column will be used after the last column. The most general specification is, e.g., `\tabskip=7pt plus7pt minus7pt` (allowing the glue between columns to stretch and shrink if necessary), and can appear any number of times in the template line.

Consider the following two examples:

```
{\tabskip=2em          %\tabskip is inside brackets so its effect ends with the table.
\halign{\it#\hfil&
        \hfil# and mice\hfil&
        \sl\hfil#\cr
\noalign{\hrule}
apples&bears&yams\cr
oranges&elephants&corn\cr
watermelons&brontosauruses&rutabagas\cr
peaches&llamas&peas\cr
\noalign{\hrule}
}
}
```

produces

<i>apples</i>	bears and mice	<i>yams</i>
<i>oranges</i>	elephants and mice	<i>corn</i>
<i>watermelons</i>	brontosauruses and mice	<i>rutabagas</i>
<i>peaches</i>	llamas and mice	<i>peas</i>

Space like this at the left and right margins is often seen in tables in astronomical journals, although not as exaggerated as here. Such space is produced with standard A&A table commands. It's a matter of taste whether this is good or bad (see comment about A&A and tables near the beginning of § 18), but you have no control over it.

In fact, it is easy to get control of this space, as follows:

```
\halign{\it#\hfil\tabskip=2em&
        \hfil# and mice\hfil&
        \sl\hfil#\t\tabskip=0pt\cr
\noalign{\hrule}
apples&bears&yams\cr
oranges&elephants&corn\cr
watermelons&brontosauruses&rutabagas\cr
peaches&llamas&peas\cr
\noalign{\hrule}
}
```

produces

<i>apples</i>	bears and mice	<i>yams</i>
<i>oranges</i>	elephants and mice	<i>corn</i>
<i>watermelons</i>	brontosauruses and mice	<i>rutabagas</i>
<i>peaches</i>	llamas and mice	<i>peas</i>

Much better!

## 18.6 Space between rows

Use `\openup 4pt` before the `\halign` to increase the space between all lines by 4pt.

```
{\openup 4pt                                % Notice that \openup is inside brackets.
\halign{\it#\hfil&
        \hfil# and mice\hfil&
        \sl\hfil#\cr
\noalign{\hrule}
apples&bears&yams\cr
oranges&elephants&corn\cr
watermelons&brontosaurus&rutabagas\cr
peaches&llamas&peas\cr
\noalign{\hrule}
}                                             % This ends the \halign
}                                             % This closes the \openup 4pt group
```

Usually, however, one wants to increase the space between some lines in the table, but not all (not heading lines, for example). The following will *not* work, because space between lines isn't set until the *end* of the `\halign`, and by then the `\openup-3pt` will have cancelled the `\openup+3pt`.

```
\halign{...template...\cr
first line\cr
\noalign{\openup 3pt}
second line\cr
third line\cr
\noalign{\openup -3pt}
fourth line\cr
etc.
}
```

Instead, add space explicitly where it is needed with `\noalign{\vskip ?pt}` between lines. For example,

```
\halign{\it#\hfil\tabskip=2em&
        \hfil# and mice\hfil&
        \sl\hfil#\tabskip=0pt\cr
\noalign{\hrule}
apples&bears&yams\cr
\noalign{\vskip 10pt}
oranges&elephants&corn\cr
watermelons&brontosaurus&rutabagas\cr
\noalign{\vskip 5pt}
peaches&llamas&peas\cr
\noalign{\hrule}
}
```

produces

<i>apples</i>	bears and mice	<i>yams</i>
<i>oranges</i>	elephants and mice	<i>corn</i>

<i>watermelons</i>	brontosauruses and mice	<i>rutabagas</i>
<i>peaches</i>	llamas and mice	<i>peas</i>

### 18.7 How to override the template for a particular entry

Suppose you want to add column headings to the table above, but you want the headings in boldface and centred over each column. The command `\omit` at the beginning of a given entry tells  $\TeX$  to *not* use the template for that column. but to use what you are about to tell it instead. To take a common example, suppose you want to centre a heading over a column for which the template specifies left or right justification:

```
\halign{\it#\hfil\tabskip=02em&
        \hfil# and mice\hfil&
        \sl\hfil#\tabskip=0pt\cr
\omit\bf\hfil Fruits\hfil&\omit\bf\hfil Animals\hfil&\omit\bf\hfil Vegetables\hfil\cr
apples&bears&yams\cr
oranges&elephants&corn\cr
watermelons&brontosauruses&rutabagas\cr
peaches&llamas&peas\cr
}
```

which gives

<b>Fruits</b>	<b>Animals</b>	<b>Vegetables</b>
<i>oranges</i>	elephants and mice	<i>corn</i>
<i>watermelons</i>	brontosauruses and mice	<i>rutabagas</i>
<i>peaches</i>	llamas and mice	<i>peas</i>

Note that although the centre column is already centred by the template, using `\omit` also prevents template addition of “and mice” to the heading.

### 18.8 More on rules

*Planck* tables should have a double rule at the top, a single rule between headings and the body of the table, and a rule at the bottom. Here’s how to do it:

```
\halign{\it#\hfil\tabskip=02em&
        \hfil# and mice\hfil&
        \sl\hfil#\tabskip=0pt\cr
\noalign{\doubleline}
\omit\bf\hfil Fruits\hfil&\omit\bf\hfil Animals\hfil&\omit\bf\hfil Vegetables\hfil\cr
\noalign{\vskip 5pt\hrule\vskip 5pt}
apples&bears&yams\cr
oranges&elephants&corn\cr
watermelons&brontosauruses&rutabagas\cr
peaches&llamas&peas\cr
\noalign{\vskip 3pt\hrule}
}
```

This uses the convenient `\doubleline` command defined in `Planck.tex`

```
\def\doubleline{\vskip 3pt\hrule \vskip 1.5pt \hrule \vskip 5pt}
```

The output begins to have a familiar look:

Fruits	Animals	Vegetables
<i>apples</i>	bears and mice	<i>yams</i>
<i>oranges</i>	elephants and mice	<i>corn</i>
<i>watermelons</i>	brontosaurus and mice	<i>rutabagas</i>
<i>peaches</i>	llamas and mice	<i>peas</i>

### 18.9 Centring a table

One way to centre a table is to use the `\center` (LaTeX uses American spelling!) environment inside the `table` or `table*` environment:

```
\begin{table*}[tmb]
\begin{center}
\caption{Sensitivity budget for LFI units.}

(\halign stuff goes in here)

\end{center}
\end{table*}
```

A&A doesn't centre the table number and title over the table, but rather left justifies them. A little weird, but that's what they do. Don't waste any time trying to figure out why the the `\caption`, located inside the centring environment, doesn't centre!

This is easy, but it can lead to entries in tables being centred sometimes when you don't want them to be, and it takes a good deal of LaTeXnical investigation to sort out the order of operations and prevent that. §18.13 shows a better way, the one that is used in the `PlanckTable.tex` file.

### 18.10 How to make a table of a specified width

To make a table a certain width  $x$ , say `\halign to  $x$` , where  $x$  is a dimension. For example,

```
\halign to 4in{                %which makes the table 4\,in wide
```

or

```
\halign to \hsize              %which makes the table the width of the column or page
```

If you do this, make sure that the `\tabskip` glue between columns can stretch or shrink, e.g., `\tabskip=2em plus 2em minus 1em`.

### 18.11 How to run something across more than one column

This often is required in multilevel headings. Use `\multispan $n$` , where  $n$  is the number of columns to be spanned. For example, to add a higher level heading across the first two columns of our favourite table, type

```
\multispan2\hfil\csc Fruits \& Animals\hfil\cr
```

Note that the `\cr` ends the line after two columns. The third column will be blank on this line. If  $n > 9$ , it must be enclosed in braces, e.g., `\multispan{13}`.

Let’s add a “fruits & animals” heading across the first two columns of the previous table. The span of a multiple-column heading should be indicated with a rule, and it works well to set the highest level heading in each column in a caps-small caps font. Doing all of this at once, including some `\noalign{\vskip}` tweaks to the spacing of the rules,

```
\halign{\it#\tabskip=2em&
        \hfil# and mice\hfil&
        \s1\hfil#\tabskip=0pt\cr
\noalign{\doubleline\vskip 5pt}
\multispan2\hfil\csc Fruits \& Animals\hfil\cr
\noalign{\vskip -3pt}
\multispan2\hrulefill\cr
\noalign{\vskip 2pt}
\omit\hfil Fruits\hfil&\omit\hfil Animals\hfil&\omit\hfil\csc Vegetables\hfil\cr
\noalign{\vskip 5pt\hrule\vskip 8pt}
apples&bears&yams\cr
\noalign{\vskip 4pt}
oranges&elephants&corn\cr
\noalign{\vskip 4pt}
watermelons&brontosaurus&rutabagas\cr
\noalign{\vskip 4pt}
peaches&llamas&peas\cr
\noalign{\vskip 4pt\hrule}
}
```

produces

FRUITS & ANIMALS		
Fruits	Animals	VEGETABLES
<i>apples</i>	bears and mice	<i>yams</i>
<i>oranges</i>	elephants and mice	<i>corn</i>
<i>watermelons</i>	brontosaurus and mice	<i>rutabagas</i>
<i>peaches</i>	llamas and mice	<i>peas</i>

### 18.12 Leaders: filling up a column with rules or dots

Tables in astronomical journals are typically a matrix of information, with rows and columns representing two different slices through the data. In that case, the entries in the leftmost column are names for the rows, and need to be distinguished from the other columns. A good way to do this is with “leaders,” rows of dots that lead the eye.

Define

```
\def\leaderfil{\leaders\hbox to 5pt{\hss.\hss}\hfil}
```

After this definition, `\leaderfil` will fill up space with dots instead of rules.

Recall, though, that  $\text{\TeX}$  sets a column to the width of its widest entry. `\leaderfil` doesn’t make the column wider, it just fills out the narrower entries with dots to equal the width of the widest entry. The solution is to fix the width of the first column to something wider than the widest entry. How wide is a matter of taste and space. Too wide and too narrow both look bad.

In the following example the first column is set to 2in wide. Note that to get a legitimate minus sign you type a hyphen in math mode, i.e.,  $-$$ .

```

\halign{\hbox to 2.15in{\# \leaderfil}\tabskip 2.2em&
\hfil#\hfil&
\hfil#\hfil&
\hfil#\hfil\tabskip 0pt\cr
\noalign{\doubleline\hrule\vskip 5pt}
\omit&Latitude&Longitude&Diameter\cr
\omit&\hfil Station\hfil&[\deg]&[\deg]&[m]\cr
\noalign{\vskip 4pt\hrule\vskip 6pt}
Bologna, Italy&44\pdeg5&$-11.3&&32\cr
Crimea, USSR&44.S&$-34.0&&22\cr
Effelsberg, FRG&50.3&$-6.8&&100\cr
Jodrell Bank, UK&53.1&2.3&&25\cr
Noto, Italy&36.7&$-12.8&&32\cr
Onsala, Sweden&57.2&$-11.9&&20\cr
\noalign{\vskip 3pt\hrule\vskip 4pt}
}

```

Station	Latitude [°]	Longitude [°]	Diameter [m]
Bologna, Italy .....	44.5	−11.3	32
Crimea, USSR .....	44.S	−34.0	22
Effelsberg, FRG .....	50.3	−6.8	100
Jodrell Bank, UK .....	53.1	2.3	25
Noto, Italy .....	36.7	−12.8	32
Onsala, Sweden .....	57.2	−11.9	20

This is a nice looking table, but with one glaring defect considered in the next section.

### 18.13 How to line up columns of numbers

It's easy to left justify, centre, or right justify entries in a column, but the entries in astronomical tables are often numbers, which should be lined up on the decimal point if they have decimal points, and on the right-most digit for integers, but should generally be centred under the column heading. The problem is that the number of digits both before and after the decimal point, or in the integer, may not be fixed, and the numbers can be negative. The third and fourth columns of the table in §18.11 show what happens when all entries are simply centred. It's ugly and hard to read. The most straightforward way to solve this looks a bit tricky and complicated at first, but after some practice becomes merely tedious.

The idea is to use a little  $\TeX$  character-parsing trickery to redefine a single character to take up the space of one numeral, and another to take up the space of a plus or minus sign. (In case you've never noticed, all numerals have the same width, and plus and minus signs have the same width.)

```

\newdimen\digitwidth           % These five lines change what an asterisk
\setbox0=\hbox{\rm 0}          % means to TeX. Instead of meaning
\digitwidth=\wd0               % "print an '*' here", it now means "leave
\catcode'\*=\active            % as much blank space as a single number
\def*{\kern\digitwidth}        % takes up".

```

```

%
\newdimen\signwidth           % These five lines change the meaning of an
\setbox0=\hbox{+}             % exclamation mark in the same way, so that it
\signwidth=\wd0                % leaves as much space as a plus or minus sign.
\catcode'\!=\active           % These definitions will disappear at the end of
\def!\{\kern\signwidth}       % the \vbox.

```

These definitions need to be active only for the table, otherwise \* and ! would be unavailable for their normal purposes. Of course, you can use any characters you want in these definitions, so if you like to fill up tables with exclamation marks use ? instead.

The previous table would become

```

{
%
\newdimen\digitwidth
\setbox0=\hbox{\rm 0}
\digitwidth=\wd0
\catcode'\*=\active
\def*\{\kern\digitwidth}
%
\newdimen\signwidth
\setbox0=\hbox{+}
\signwidth=\wd0
\catcode'\!=\active
\def!\{\kern\signwidth}
%
\halign{\hbox to 2.15in{\# \leaderfil}\tabskip 2.2em&
        \hfil#\hfil&
        \hfil#\hfil&
        \hfil#\hfil\tabskip 0pt\cr
\noalign{\doubleline\vskip 2pt}
\omit&Latitude&Longitude&Diameter\cr
\omit\hfil Station\hfil&[\deg]&[\deg]&[m]\cr
\noalign{\vskip 4pt\hrule\vskip 6pt}
Bologna, Italy& 44.5&-$-11.3&*32\cr
Crimea, USSR& 44.5&-$-$34.0&*22\cr
Effelsberg, FRG& 50.3&*-$-6.8&$100\cr
Jodrell Bank, UK&53.1&!*2.3&*25\cr
Noto, Italy& 36.7&-$-$12.8&*32\cr
Onsala, Sweden& 57.2&-$-$11.9&*20\cr
\noalign{\vskip 3pt\hrule\vskip 4pt}
}}

```

Station	Latitude [°]	Longitude [°]	Diameter [m]
Bologna, Italy	44.5	-11.3	32
Crimea, USSR	44.5	-34.0	22
Effelsberg, FRG	50.3	-6.8	100
Jodrell Bank, UK	53.1	2.3	25

Noto, Italy .....	36.7	-12.8	32
Onsala, Sweden .....	57.2	-11.9	20

In some cases it may be necessary to define a symbol to stand for the width of a decimal point or some other symbol used in the table.

#### 18.14 Adding footnotes to a table

*A<sup>E</sup>A* allows long captions after the title of the table, but in many cases footnotes are still needed. Different journals use different formats for table footnotes. *A<sup>E</sup>A* sets footnotes the width of the column or page, and provides `\tablefoot` and `\tablefoottext` commands to achieve their style. To use the `\halign` scheme described here, we have to capture the width of one column or the whole page and use it to typeset the footnote, depending on whether the table is one or two columns wide.

To do that, define two commands, `\endPlancktable` for one column, and `\endPlancktablewide` for two-column tables.†

```
\def\endPlancktable{\tablewidth=\columnwidth
  $$\hss\copy\tablebox\hss$$
  \vskip-\lastskip\vskip -2pt}

\def\endPlancktablewide{\tablewidth=\textwidth
  $$\hss\copy\tablebox\hss$$
  \vskip-\lastskip\vskip -2pt}
```

Also define a command for a table footnote.

```
\def\tablenote#1 #2\par{\begingroup \parindent=0.8em
  \abovedisplayshortskip=0pt\belowdisplayshortskip=0pt
  \noindent
  $$\hss\vbox{\hsize\tablewidth \hangindent=\parindent \hangafter=1 \noindent
  \hbox to \parindent{#1\hss}\strut#2\strut\par}\hss$$
  \endgroup}
```

N.B. — In versions of the *Planck* Style File earlier than September 2012, the footnote symbol was set by `\hbox to \parindent{#1\hss}`, reducing the typing necessary to get a superscript character. That was convenient unless one wanted a non-math symbol, or specified a math symbol between dollar signs (e.g., `\dag`), in which case the error messages were not helpful in the slightest. Now one must be explicit.

In the *LaTeX* input file, it looks like this:

```
\setbox\tablebox=\vbox{\halign
%
% table stuff
%
}
\endPlancktable          % or \endPlancktablewide
\tablenote a Whatever you want in tablenote ‘‘a.’’\par
```

That’s it. Here’s an example.

```
\centerline{\csc Assumed EVN Stationsa}
```

† N.B. — In versions of *Planck.tex* earlier than 15 November 2010, this command was called “`\endtable`,” which conflicted sometimes with a command buried deep in the *aa.cls* file. The problem is fixed by `\endPlancktable`.

```

\vskip -8pt
\setbox\tablebox=\vbox{
%
\newdimen\digitwidth
\setbox0=\hbox{\rm 0}
\digitwidth=\wd0
\catcode'\active
\def*\{\kern\digitwidth}
%
\newdimen\signwidth
\setbox0=\hbox{+}
\signwidth=\wd0
\catcode'\active
\def!\{\kern\signwidth}
\halign{\hbox to 2.15in{#\leaderfil}\tabskip 2.2em&
\hfil#\hfil&
\hfil#\hfil&
\hfil#\hfil\tabskip 8pt\cr
\noalign{\vskip 3pt\hrule\vskip 1.5pt\hrule\vskip 5pt}
\omit\hfil Station\hfil&Latitude&W. Longitude&Diameter [m]\cr
\noalign{\vskip 4pt\hrule\vskip 6pt}
\noalign{\doubleline\vskip 2pt}
\omit&Latitude&Longitude&Diameter\cr
\omit\hfil Station\hfil&[\deg]&[\deg]&[m]\cr
\noalign{\vskip 4pt\hrule\vskip 6pt}
Bologna, Italy& 44.5&\$-11.3&*\$32\cr
Crimea, USSR& 44.5&\$-$34.0&*\$22\cr
Effelsberg, FRG& 50.3&*\$-6.8&*\$100\cr
Jodrell Bank, UK&53.1&!*2.3&*\$25\cr
Noto, Italy& 36.7&\$-$12.8&*\$32\cr
Onsala, Sweden& 57.2&\$-$11.9&*\$20\cr
\noalign{\vskip 3pt\hrule\vskip 4pt}
} }
\endPlancktable

```

\tablenote a An aperture efficiency of 0.3 was assumed for Effelsberg. All other station parameters were assumed to be identical to those of VLBA stations.\par

This produces

ASSUMED EVN STATIONS<sup>a</sup>

Station	Latitude [°]	Longitude [°]	Diameter [m]
Bologna, Italy .....	44.5	-11.3	32
Crimea, USSR .....	44.5	-34.0	22
Effelsberg, FRG .....	50.3	-6.8	100
Jodrell Bank, UK .....	53.1	2.3	25
Noto, Italy .....	36.7	-12.8	32
Onsala, Sweden .....	57.2	-11.9	20

<sup>a</sup> An aperture efficiency of 0.3 was assumed for Effelsberg. All other station parameters were assumed to be identical to those of VLBA stations.

### 18.15 Paragraphs as table entries

Table entries sometimes are more or less like paragraphs. In such cases, you want  $\text{\TeX}$  to choose line breaks and justify the margins. The way to do it is with a variant of putting things in  $\text{\vbox}$ s, as shown in the example below. A  $\text{\vtop}$  box is like a  $\text{\vbox}$ , except the top line of the  $\text{\vtop}$  box lines up with the entries in the other columns. If a  $\text{\vbox}$  had been used, the *bottom* line of the  $\text{\vbox}$  would have lined up with the entries in the other columns. Here's an example.  $\text{\TeX}$ 's black boxes indicate that there is no way to break the lines that satisfies the specifications on uniformity of word spacing in effect at the time. This is a common problem in typesetting narrow columns. Read the entries in Column 2 for two solutions, both of which should be in your "toolkit."

Column 1	Column 2
Entry 1 .....	This is a long entry to show how a paragraph can be typeset and used as a table entry. A $\text{\vtop}$ box is used so that the first line of the paragraph lines up horizontally with the entry in column #1, and hanging indentation gives a good appearance.
Entry 2 .....	Narrow columns can be difficult for line breaks. Relaxing $\text{\TeX}$ 's default and stringent requirement on uniformity of word spacing by increasing $\text{\tolerance}$ , possibly all the way to 10000 (in effect, no requirement), will solve the problem, possibly at the cost of wide spaces between words in some lines.
Entry 3 .....	It is sometimes easier, however, to play around with the width of the column. In this example, $\text{\hsize=3in}$ sets the width of Column 2. $\text{\hsize=3.2in}$ makes the problems go away.
Entry 4 .....	This shows why a $\text{\vtop}$ should be used instead of a $\text{\vbox}$ , which lines up on the last line of the paragraph instead of the first.

Here's what produced the table above:

```

\setbox\tablebox=\vbox{
\halign{\hbox to 2.0in{#\leaderfil}\tabskip 2em&
      \vtop{\hsize 3.0in\hangafter=1\hangindent=1em\noindent\strut#\strut\par}
      \tabskip=0pt\cr
\noalign{\doubleline\vskip 2pt}
\omit\hfil Column 1\hfil&\omit\hfil Column 2\hfil\cr
\noalign{\vskip 6pt\hrule\vskip 6pt}
Entry 1&This is a long entry to show how a paragraph can be typeset and used as a
      table entry.  A \vtop box is used so that the first line of the paragraph lines
      up horizontally with the entry in column \#1, and hanging indentation gives a
      good appearance.\cr
\noalign{\vskip 3pt}
Entry 2&Narrow columns can be difficult for lines breaks.  Relaxing \TeX's
      default and stringent requirement on uniformity of word spacing by increasing
      \tolerance, possibly all the way to 10000 (in effect, no requirement), will solve
      the problem, possibly at the cost of wide spaces between words in
      some lines.\cr
\noalign{\vskip 3pt}
Entry 3&It is sometimes easier, however, to play around with the width of
      the column.  In this example, \hsize=3in sets the width of Column 2.
      \hsize=3.2in makes the problems go away.\cr
\noalign{\vskip 6pt}
Entry 4&\omit\vbox{\hsize 3.0in\hangafter=1\hangindent=1em\noindent\strut This
      shows why a \vtop should be used instead of a \vbox, which lines up on the
      last line of the paragraph instead of the first.\strut\par}\cr
\noalign{\vskip 3pt\hrule\vskip 4pt}
} }
\endPlancktable

```