STYLE GUIDE

for

PLANCK PAPERS

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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

A&A also has a useful English usage guide, available at

http://www.aanda.org/doc_journal/instructions/aa_english_guide.pdf.

Both can be found under "Author Information" at http://www.aanda.org/.

1.1 Changes since 2015

Changes since the 2015 edition of this document are highlighted with the following colour-coding:

this is an example of "new material;"

this is an example of "modified material."

2 TEX STUFF

The A&A format is implemented in the A&A document class file `aa.cls`, available from

http://www.aanda.org/

and from the *Planck* SVN at

https://scisvn01.esac.esa.int/Planck_Publication_Management

In the 2013 papers, we used `aa.cls` v7.0. A&A is now up to v8.2, although v7.0 is still allowed by A&A. Most of the differences between v7.0 and v8.2 need no comment here, but there are three compatibility issues of note.

1) The "structured" abstract that was the default in v7.0 no longer exists in v8.0, eliminating the need for the `[traditabstract]` option in the `\document{aa}` command at the beginning of the LaTeX file.

2) The 2013 version of the `Planck.tex` file (see below) is not compatible with `aa.cls` v8.2. Make sure to use the current version of `Planck.tex`, always available at

https://scisvn01.esac.esa.int/Planck_Publication_Management

3) Up until September 2014, *Planck* author lists were generated with "`\\ \and`" between institution names. With `aa.cls` v7.0, the resulting double space between institution names at the end of *Planck* papers could be fixed by putting `\raggedright` immediately before `\end{document}`. This kludge no longer works with `aa.cls` v8.2. Author lists are now generated with "`\goodbreak \and`" between institutions. No `\raggedright` is required. This is still a kludge to deal with a problem that A&A should fix in `aa.cls`, but it works until they do.

Unfortunately, `aa.cls v8.2` puts long lists of institutions (the kind *Planck* papers always have!) immediately following the references, and before the appendices (if any). This is weird, to put it politely, and we are trying to get it changed. **Until we do, however, it is best to use aa.cls v7.0. (Specify "traditabstract," of course. The institution list fix is backwards compatible.)**

2.1 Planck.tex

LaTeX commands useful and 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.

There were two important changes in `Planck.tex` in 2015. First, as mentioned above, a command defined in earlier versions conflicted with `aa.cls` versions 8.0 and later. That command was

removed. If you use `Planck.tex` from 2013 with these later versions of `aa.cls`, you'll get an immediate and unhelpful error message. Second, the `\setsymbol{...}` definition machinery to specify instrumental and other parameters proved unworkable. All of the `\setsymbol` commands have been removed. Attempts to use this machinery will fail.

2.2 A fix for an annoying LaTeX problem

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 usually fixes this problem and a few others.

2.3 Active links

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/fermibsl/}}`. Occasionally LaTeX will complain because of a hyperlink being split across a page break — in such cases, then simplest solution is to find the offending link and enclose it within `\mbox{}`.

3 HOW TO REFER TO *PLANCK* AND OTHER PROJECTS

Refer to "the *Planck* project," "the *Planck* spacecraft," or "*Planck*." The name should be italicized. 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." By the same logic "Planck" is not italicized in other proper noun phrases, such as "Planck Catalogue of Compact Sources." Italics are never used for "Planck constant" or "Max Planck."

3.1 Other experiments

For the 2013 papers, we requested that all spacecraft names be italicized. This conflicts with the A&A house style, which was adopted for the 2015 papers (irrespective of whether we all agree that it makes sense!). In this scheme, an instrument name is *not* italicized unless it is named after a person, so it is "*Chandra*," "*Fermi*," "*Herschel*," and "*Spitzer*," but "Gaia," "GALEX," "IRAS," and "ISO." The names of instruments and non-satellite experiments remain in roman font, e.g., "ACT," "DIRBE," "HFI," "LFI," "SPIRE," and "SPT." Note that the convention means that you should write "*Hubble* Space Telescope," "*Wilkinson* Microwave Anisotropy Probe," and "XMM-*Newton*," but just "HST," "WMAP," and "XMM."

3.2 The possessive form

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.

4 HOW TO REFER TO *PLANCK* SPECIFICS

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 released in March 2013. Names for the second and likely final versions of the catalogues to be released in 2015 are not yet settled. When they are, they'll be added here.

The *Planck* cryocoolers should be referred to as the "sorption cooler," the "^{4}He-JT cooler," and the "dilution cooler." The command \HeJT, defined in Planck.tex, produces ^{4}He-JT for convenience.

Individual *Planck* surveys are precisely defined subsets of the data and should be referred to using capital letters, i.e., "Survey 1," "Survey 2," etc. Similarly for "Year 1," etc.

5 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 A&A "Guide to the English Editing" (see Sect. 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)."

6 ACRONYMS

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. The choice of indefinite article (i.e., "a" or "an") before an acronym is determined by how the acronym is conventionally pronounced, so it is "an SFR estimate," but "a UFO." Although most acronyms are pronounced as a series of letters, there are exceptions, which can also affect the article, e.g., "a NASA mission." If you use many acronyms, include a list of them at the end of the paper.

7 TITLE

The title of *Planck* general and special "early" papers is of the form "*Planck* early results. XX. Specific title of paper," while the products and cosmology papers from 2013 were similarly "*Planck* 2013 results. XX. Specific title of paper," with XX being 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 normally 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 Sect. 3 above about the italics.

For intermediate papers use "*Planck* intermediate results. XX. Specific title of paper" (with no punctuation at the end). For cosmology and product papers in 2015 use "*Planck* 2015 results. XX. Specific title of paper" (once again, no punctuation at the end).

The "running title" (which appears at the top of each page of the paper) should be the title, or a shorter version of the title, but does not need the series name and roman numerals. The "running author" should simply be "Planck Collaboration."

8 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. In `aa.cls v7.0`, used for the 2011 and 2013 *Planck* papers, the default was the A&A "structured" abstract with its amateurish-looking headings. To obtain the "traditional" abstract, one had to specify `\documentclass[traditabstract]{aa}` on the first line of the input file. With `aa.cls v8.2`, the "structured" abstract has disappeared (good riddance!); all that's required is `\documentclass{aa}`.

It is preferable to write the abstract as a single paragraph. Shorter is better. References should be avoided in the abstract. Acronyms should only be defined if they are used again in the abstract.

Key words appear at the end of the abstract. These must be selected from the approved list:

http://www.aanda.org/index.php?option=com_content\&task=view\&id=170\&Itemid=173 ,

rather than just made up! Key words should be separated by en-dashes (`--` in TEX), not some other form of abbreviation.

9 CORRESPONDING AUTHOR AND ACKNOWLEDGEMENTS

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 Sect. 2.3 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 "*Planck*" in the title or abstract!

`\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 and led by Principal Investigators from France and Italy, telescope reflectors provided through a collaboration between ESA and a scientific consortium led and funded by Denmark, and additional contributions from NASA (USA).}`

A standard acknowledgement in both long and short forms was provided for use at the end of the early and intermediate papers, and has also been used for the cosmology and product papers. The current version of the basic *Planck* acknowledgement is:

`The Planck Collaboration acknowledges the support of: ESA; CNES, and CNRS/INSU-IN2P3-INP (France); ASI, CNR, and INAF (Italy); NASA and DoE (USA); STFC and UKSA (UK); CSIC, MINECO, JA, and RES (Spain); Tekes, AoF, and CSC (Finland); DLR and MPG (Germany); CSA (Canada); DTU Space (Denmark); SER/SSO (Switzerland); RCN (Norway); SFI (Ireland); FCT/MCTES (Portugal); ERC and PRACE (EU). A description of the Planck Collaboration and a list of its members, indicating which technical or scientific activities they have been involved in, can be found at \url{http://www.cosmos.esa.int/web/planck/planck-collaboration}.`

Additional acknowledgements will be appropriate for individual papers, for example, the use of the `HEALPix` package, or data from another instrument, mission, or repository, such as *XMM*, *Herschel*, 2MASS, SDSS, LAMBDA, etc. The acknowledgements section should not contain references. Instead, cite the relevant paper somewhere in the main body of the text.

10 UNITS

1) Units should *always* be in a roman font, *never* in italics!! For example, $g = 9.8\,\mathrm{m\,s^{-2}}$ is correct, but $g = 9.8\,m\,s^{-2}$ 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. For example, "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 "μm," 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, $H_0 = 68$ $\mathrm{km\,s^{-1}\,Mpc^{-1}}$ is obtained by `$H_0=68$\,km\,s$^{-1}$\,Mpc$^{-1}$` or `$H_0=68\,{\rm km}\,{\rm s}^{-1}\,{\rm Mpc}^{-1}$`. Note that 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 $\mathrm{km\,s^{-1}}$, *not* km/s. This applies to all compound units, e.g., $\mathrm{MJy\,sr^{-1}}$, rather than MJy/sr.

9) Write "s," *not* "sec."

10) In figure labels and tables, enclose units in brackets, e.g., "Time [s]," "Frequency [Hz]," "Sensitivity $[\mu\mathrm{K\,s^{1/2}}]$." 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 Sect. 18.13 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, °, ′, ″, which can be obtained with `\deg`, `\arcm`, and `\arcs`, 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°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^2" rather than "square degrees" or "sq. deg."

13) It is good practice to try to avoid ambiguity by making sure that units apply to both values and uncertainties, e.g., $x = (3 \pm 1)\,\mathrm{m}$, not $x = 3 \pm 1\,\mathrm{m}$. Similarly write "we use the 70 % and 80 % masks" rather than "we use the 70 and 80 % masks."

14) If a cosmological model is required, use the fiducial *Planck* model found at
http://hfilfi.planck.fr/index.php/Site/Commonalities.
This will be updated for the 2015 papers.

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

11 NOTATION

1) The acronym for cosmic microwave background is "CMB," not "CBR," "CMBR," or anything else.

2) Use ℓ, obtained with `$\ell$`, for the multipole index only. Galactic longitude is written "l," obtained with `$l$`.

3) The plural of C_ℓ (`$C_\ell$`) should be written C_ℓs (`$C_\ell$s`), *not* C_ℓ's (`$C_\ell$'s`).

4) "E" and "B" should be in italics in phrases such as B-modes, as well as in subscripts and superscripts such as C_ℓ^{EE}. The same applies to T, Q, and U. Although these are used as labels, they are also variables, and this rule ensures consistency in sentences such as "we estimate the B-mode power spectrum, C_ℓ^{BB}."

5) The symbol for flux density is S_ν (obtained with `$S_\nu$`), *not* f_ν or anything else. *Planck* measures flux density, *not* "flux," and the use of "flux" as shorthand for "flux density" is **never** allowed, since "flux" is a physically distinct quantity.

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`. Note that setting "=1" in text mode bypasses the normal math mode spacing of the equals sign, which is too wide for this situation; as an alternative use small spaces, i.e., "CO $J\,{=}\,1\,{\rightarrow}\,0$," obtained with `CO $J\,{=}\,1\,{\rightarrow}\,0$`. If there are many instances, abbreviation to "CO(1→0)" after the first instance is all right.

9) The notation for all cosmological parameters should follow table 1 in the 2013 parameters paper, Planck Collaboration XVI.

10) Avoid the use of excessive numbers of digits when presenting numerical results. See Sect. 18.1 for more details.

11) Ordinal numbers should be written 17th, rather than 17-th or 17$^{\text{th}}$. The same applies to variables, e.g., ith.

12) Specific WMAP releases and results can be referred to as, e.g., "the WMAP 9-year data set" or shortened to "WMAP-9."

13) Use "γ-ray" not "gamma-ray" (and mixing them in the same paper is even worse!). It should always be hyphenated, even when used as a noun, just as in "X-ray."

14) A&A prefer to use "S/N" for "signal-to-noise ratio," rather than "SNR" (which they say can be confused with "supernova remnant"). Let's agree to go with "S/N" (even if we suspect that the two uses of "SNR" would always be distinguished by context). Note that this is an abbreviation for "signal-to-noise ratio" and not "signal-to-noise."

15) For atomic ionization states, use the A&A macro: e.g., "`\ion{H}{ii}`," which yields "H II."

16) The transpose symbol (for vectors and tensors) should be capital and should *not* be in italic font, since that causes possible confusion with the variable T. The best solution is probably to use the sans-serif font, e.g., "`\vec{x}^{\sf T}`" or "`\vec{x}^\mathsf{T}`."

12 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) Precise rules for the use of commas are complicated. As a rough guide, if adding a comma would help the reader to take a brief pause, which would avoid ambiguities and make the sentence easier to understand, then definitely the comma should be added. However, in many instances the inclusion of a comma is a matter of taste. We have added a discussion of some of the subtle issues in an Appendix.

3) A&A uses the "serial comma" (also called the "Oxford 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." The same applies to "or," e.g., "stracciatella, fragola, or "zuppa inglese."

4) 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."

5) Every internal reference to a figure or table should use `\ref{label}` to ensure that a hyperlink is created in the final PDF file.

6) The correct way to refer to a figure, table, or equation in a paper is "Fig. 1," "Table 2," and "Eq. (3)," respectively. At the beginning of a sentence, write "Figure" and "Equation" in full. When an equation is referred to in parentheses the brackets are dropped, so "(see Eq. 42)." To reference an equation number with parentheses, "Eq. (3)," use `\eqref`; to reference the number without parentheses, "Eq. 3," use `\ref`. If referring to a figure, table, or equation in *another* paper, it is good practice to use the full uncapitalized words "figure," "table," or "equation," to avoid any confusion between the numbered items in the paper being referred to and those in the paper being written.

7) 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. However, "zodiacal" and "ecliptic" should *not* be capitalized.

8) Capitalize "Galactic" when referring to the Milky Way, e.g., "Galactic plane." Capitalize "Universe" when referring to the cosmos in which we live, reserving "universe" for different theoretical possibilities.

9) "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.

10) Software program names should be set in the fixed-width "tt" font, e.g., `HEALPix`, `PLIK`, and `Commander` (obtained with `{\tt HEALPix}`, `{\tt PLIK}`, and `{\tt Commander}`).

11) The abbreviation of declination is "Dec," not "DEC" or "Dec." The abbreviation of right ascension is "RA," not "R.A."

12) Words describing directions, such as "north," "southwest," and "eastern," should not be capitalized unless they are part of a proper noun (like "North America").

13) The Oxford English Dictionary (OED, the ultimate authority for standard English) capitalizes "Gaussian." We will adopt that as the *Planck* convention.

14) Italics should be reserved for emphasis. Don't use italics for expressions in Latin (or other languages). Italics should also not be used for special phrases; it is better to define a special phrase using quotations the first time it is introduced, and leave it at that.

15) Itemized lists should be properly punctuated. This is achieved through one of two possibilities. The first is a list (usually of fairly short statements) introduced using a colon and with the items

separated by semi-colons, so the entire list is read as a single sentence. The second is a list of longer entries, *not* introduced with a colon, each item of which should start with a capital letter and end with a period.

Here's an example of the first kind of itemized list:

– this is the first item;

– this is the second item;

– and here's the third item, which can be long, but can only consist of a single sentence in order to ensure the punctuation is consistent.

Here's an example of the second kind of itemized list, which is *not* introduced with a colon.

– This is the first item, which should start with a capital letter and end with a full stop.

– This is another item, which might be longer than any items in the first kind of list.

– This is one more item, which can be long. Items in this sort of list can consist of multiple sentences and hence couldn't be part of a semi-colon-separated list.

Whether these are numbered or unnumbered lists is a matter of choice, but numerical lists are preferred when the order is important, or if specific items are going to be referred to in the text. The particular bullet symbol used is also a choice (within reason!), but the A&A default is dashes. If the items in a list are essentially whole paragraphs, then it may be better to use the \paragraph{...} environment, which gives a separate heading for each item.

13 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. There is no longer a requirement to use a "standard paragraph," but it is still appropriate to cite *all* instrument and product papers on which a new paper depends. 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) There should be no text before the beginning of section 1 of a paper. It is fine to have a brief block of introductory text at the beginning of a section (section 3, say), but if this isn't short it is probably a good idea to give it a numbered sub-section (i.e., call it section 3.1); this makes it easier to refer to that part of the paper. A section should not contain a single sub-section, i.e., if there's section 7.1, but no section 7.2, then either rename the introductory material as section 7.1 (and the sub-section as section 7.2) or remove the sub-section heading, making the whole thing just section 7.

4) 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.

5) New material should not be introduced in a section headed "Conclusions." Use a "Discussion" section for that.

6) Strive for conciseness; avoid unnecessary verbiage.

14 USE (AND MISUSE) OF THE ENGLISH LANGUAGE

Use standard British words and spellings. We take the Oxford English Dictionary (OED) as our authority on British spelling. Examples follow. The first six 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. There are many other examples of uncountable nouns that don't take an "s" when pluralized; for the purposes of *Planck* papers, the ones that come up the most relate to abstract ideas or substances, e.g., efficiency, evidence, and leakage (with more examples below).

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) *Significance* is similarly used as a singular noun, so that **significances** is incorrect. If necessary write "levels of significance."

Use of the word "significant" when *not* discussing statistical significance can be confusing. Be careful, or don't do it. Synonyms that can be usefully substituted include "considerable," "sizable," and "substantial."

5) *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.

6) *Permit* is also a transitive verb. See item 5 above.

7) 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.

8) "*Modelisation*" (or "modelization") is not in the OED, at least not yet. Don't use it. "Model" or "modelling" are probably what you want.

9) *"Associated to"* is usually incorrect in English, and should be "associated with."

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

11) *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 non-restrictive. 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."

12) 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 maroon.

Note that we specify "polarize" instead of "polarise." Although both "-ize" and "-ise" are used in British English, the OED prefers "-ize." "Polarise" certainly appears a few times in the Early and Intermediate Results papers, the major use of "polarize" and related nouns is now with us, so it seems worth a minor inconsistency with previous papers in order to follow the OED more closely in the future.

13) "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.

14) For the plural of "halo" write "halos," not "haloes."

15) 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.

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

17) Use active voice when suitable, particularly when necessary for correct syntax (e.g., "To address this possibility, we constructed a λ Zap library...," not "To address this possibility, a λ Zap library was constructed..."). But see Sect. 8 on abstracts.

18) Write concisely (e.g., "even though," not "in spite of the fact that").

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

20) 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. Similarly try to minimize claims that a result is "interesting," "important," or "critical." Do not mention your own work in progress within the text (cross reference the appropriate *Planck* paper).

21) "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...."

22) Avoid using "systematic" or "systematics" as a noun. Use "systematic errors" or "systematic effects."

23) 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)," and "cosmic microwave background (CMB)," not "Cosmic Microwave Background (CMB)."

24) "Time-ordered data" should be hyphenated. "Bandpass," "feedhorn," "mapmaking," "nonlinear," "sidelobe," and "submillimetre" should not. As another example, it should be "far sidelobes," rather than "far-side lobes." Furthermore, "stray light" should be written as two words. An application of this is that it is often a good idea to write "the 1.5-m telescope, even though there would be no hyphen in "the aperture was $1.5\,\mathrm{m}$"; the most common example in *Planck* papers probably lies in phrases like "30-GHz channel." The rules of hyphenation can be daunting because there are so many cases (see, e.g., `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.

25) One hyphenation guideline is clear, namely that a hyphen is included in adjectival phrases but not in nouns. So it is "the power-law spectrum," but "a power law was fit" and "the high-ℓ behaviour," but "an effect seen at high ℓ."

26) Nouns used adjectivally are **never** plural in English, not even once! For example, "the galaxy redshifts" is correct, even although there are multiple galaxies, but "the clusters masses" is incorrect.

Table 1. BRITISH AND AMERICAN SPELLING CONVENTIONS[a] AND EXAMPLES

	British	American
Words ending in -re British English words that end in *-re* often end in *-er* in American English.	centre (centred, centring) fibre litre metre theatre	center (centered, centering) fiber liter meter theater **or** theatre
Words ending in -our British English words ending in *-our* usually end in *-or* in American English.	colour flavour humour labour neighbour	color flavor humor labor neighbor
Words ending in -ize or -ise Verbs in British English that can be spelled with either *-ize* or *-ise* at the end are always spelled with *-ize* at the end in American English.	apodize **or** apodise apologize **or** apologise ionize **or** ionise minimize **or** minimise normalize **or** normalise organize **or** organise polarize **or** polarise realize **or** realise recognize **or** recognise summarize **or** summarise	apodize apologize ionize minimize normalize organize polarize realize recognize summarize
Related nouns follow the same convention.	apodization **or** apodisation ionization **or** ionisation normalization **or** normalisation polarization **or** polarisation	apodization ionization normalization polarization
However, there are some exceptions, which never take the *-ize* form in either variant of English.[b]	arise comprise revise surprise	arise comprise revise surprise
Words ending in -yse Verbs in British English that end in *-yse* are always spelled *-yze* in American English.	analyse	analyze
Words ending in a vowel plus l In British spelling, verbs ending in a vowel plus *l* double the *l* when adding endings that begin with a vowel. In American English, the *l* is not doubled.	*fuel* fuelled fuelling *model* modelled modelling *travel* travelled travelling traveller	*fuel* fueled fueling *model* modeled modeling *travel* traveled traveling traveler
Nouns ending with -ence Some nouns that end with *-ence* in British English are spelled *-ense* in American English.	defence licence offence pretence	defense license offense pretense
Nouns ending with -ogue Some nouns that end with *-ogue* in British English end with either *-og* or *-ogue* in American English. The distinctions here are not hard and fast. The spelling *analogue* is acceptable but not very common in American English; *catalog* has become the US norm, but *catalogue* is not uncommon; *dialogue* is still preferred over *dialog*.	analogue catalogue dialogue	analog **or** analogue catalog **or** catalogue dialog **or** dialogue
Other examples A few more British versions that should be used in *Planck* papers.	artefact disc (except for a computer disk) formulae grey manoeuvre towards **or** toward	artifact disk formulas gray maneuver toward **or** towards

[a] Mostly from `http://oxforddictionaries.com/words/british-and-american-spelling`
[b] And note that "noise" is never "noize," so you can't simply do a global search and replace for *-ise* words!

27) 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."

28) Spell out numbers up to and including ten; use digits above ten except at the beginning of a sentence.† However, numbers with units are always written with digits, including things like "5 σ." Similarly, quantities that are multiplicative factors (even if they happen to be integers) will often be better written using digits, e.g., "5 times higher" or "a factor of 2."

29) Sentences should not start with numbers or variables. Rewrite the sentence if necessary.

30) Avoid the use of whole sentences in brackets. This can be a useful device in conversational emails, but when writing a paper its intended meaning is often unclear. Instead put the comment at the end of the previous sentence (in brackets, or after a semi-colon), convert to a footnote if deemed necessary, or simply remove the brackets altogether.

31) Use "reliability" rather than "purity" for the probability that a source is real. For example, the reliability of the catalogue is 0.95.

32) Use "data set" rather than "dataset" or "data-set."

33) The word "data" is always plural (e.g., "these data show"), while "none" can be singular (e.g., "none of the sky is masked") *or* plural (e.g., "none of the galaxies were spirals").

34) The common abbreviation for "root mean square" should be "rms," rather than "r.m.s." or "RMS."

35) It often sounds more elegant to avoid using the word "do," but instead to use "perform" or "carry out." For example, "we carried out the calibration procedure" rather than "we did the calibration procedure."

36) As the word "as" can be used as an adverb or preposition, as well as as a conjunction (note this example!), then sentences can sometimes be difficult to parse. Substitution of "since" or "because" for "as" where appropriate (particularly as a conjunction) may avoid confusion.

37) The word "comprised" is sometimes misused in the phrase "is comprised of," which should be replaced with the more grammatically correct "is composed of" (or perhaps "comprises").

38) The correct word is "publicly," not "publically." However, in common examples, there is often a better way to express the same meaning without using the word at all.

39) "Non" is a prefix, not a word, and hence a hyphen is required in words such as "non-Gaussian" and "non-relativistic." Other prefixes that usually require a hyphen in English include "self-" and "quasi-." Most other prefixes do not require a hyphen (e.g., "infra," "inter," "multi," "pseudo," "sub," and "ultra"), but should be hyphenated before a proper noun (like "pre-*Planck*"), or if it would otherwise cause two vowels to appear together (like in "pre-eminent"), or simply to avoid confusion. But in any case, none of these prefixes should be written as separate words.

40) Some words that are fairly common in British English, while formally correct, sound quaint to non-British speakers of English. Examples include "amongst," "whilst," and "bespoke." Such words should probably be avoided.

41) Avoid starting sentences with "Note that . . ." or "Please note . . .," or similar. Although harmless if used rarely, this sort of construction gives the text a very prescriptive tone. In practice the meaning is often preseved by simply dropping the "Note that . . ." words.

42) When referring to objects in relation to the sky, astronomical usage differs from everyday usage. So although it is correct to say "pie in the sky" and "up in the sky," etc., in astronomy we are usually considering the sky as the projected celestial sphere and hence we say "galaxy on the sky."

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† And don't ask about the pathological case of ranges like "seven to 11!"

43) Plurals deriving from Latin or ancient Greek are exceptions to the usual rules of English grammar, and simply need to be learned. For example, the plural of "criterion" is "criteria" and the plural of "index" is "indices." Other words that sometimes come up in *Planck* papers include "analyses," "appendices," "formulae," "hypotheses," "matrices," "maxima," "minima," "nebulae," "nuclei," "parentheses," "phenomena," "radii," and "spectra." Even where a word has two acceptable plural forms, the Latin-style plurals are almost always preferred in technical writing. An exception is the radio antenna, which is usually pluralized as "antennas."

15 LaTEX AND TEX; TYPESETTING MATHEMATICS

1) *Paragraphs*. Always indicate the start of a new paragraph by a blank line in the TEX code. Special layout commands such as `\vskip` and `\noindent` are not generally required; the journal-supplied LaTEX styles will take care of layout.

2) *Blank lines*. Don't leave a blank line before or (particularly) 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
%
\begin{equation}
E=mc^2,
\end{equation}
%
where $c$ is the speed of light in vacuum.
```

3) *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."

4) *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., "`$-17.2\pm0.3$`" rather than "`$-$17.2$\pm$0.3`" in order to get correct spacing. The former gives -17.2 ± 0.3, while the latter gives -17.2 ± 0.3.

5) *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).

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

7) *Symbols*. Use italics (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-$z$`).

8) *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 15.9 below), write "an average factor of 1.8," omitting the meaningless "about."

9) *Approximations*. 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 $\sim$."

Don't use "$\sim$" when you mean "$\propto$."

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 the point above!).

For "less (and greater) than approximately" either use the A&A macro "\la" (and "\ga") or the Planck.tex macro "\lsim" (and "\gsim"), but don't mix them.

Avoid using the "$O(x)$" or "$\mathcal{O}(x)$" notation except for describing asymptotic behaviour or scaling. Instead just say "about 10^{-6}" or "approximately 10^{120}."

10) *Superscripts*. Use roman fonts for tags or labels in subscripts, e.g., $n_{\rm e}$, $z_{\rm rec}$, 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 ith redshift under consideration, while $z_{\rm i}$ (obtained with $z_{\rm i}$) might be defined as the reionization redshift.

An exception is made for labels that are *also* variables, e.g., "the x-component of vector $\boldsymbol{V}$ is V_x." This will often apply to T, Q, U, E, and B (see Sect. 11, item 4).

Particle physicists sometimes write particle names in italics, e.g., n_e instead of $n_{\rm e}$. 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."

11) *Functions*. Always use the standard TEX commands for operators, \log, \cos, \sin, \ln, etc. Right: $\log{S}$. Wrong: log(S), or ${\rm log}\, S$, or anything else. Using the TEX commands will also preclude capitalization of these operators, which is almost always incorrect.

12) *Vectors and tensors*. A&A recommends typesetting vectors and tensors with \vec{A} and \tens{B}. These produce bold italics and upright sans-serif characters, i.e., $\boldsymbol{A}$ and B, respectively.

13) *Brackets*. The usual ordering of brackets is $\{[(\ldots)]\}$. Only deviate if this if there is good reason, and never use the same type for adjacent 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.

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

If you *do* use a multi-letter symbol for a variable, it **must** be in roman, e.g., "SFR $= 10\,{\rm M}_\odot\,{\rm yr}^{-1}$," obtained with "${\rm SFR} = 10\,\Msolar\,yr\mo$."

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

16) *Tall equations*. It looks ugly when in-line equations contain expressions or brackets that are high enough to force TEX to insert extra space between the lines of text. As a general guide, if it increases the line spacing, then it's time to use a displayed equation.

17) $N_{\rm side}$. Write "$N_{\rm side}$" ($N_{\rm side}$), not "nside."

18) χ^2. Write χ^2 rather than "chi-square." Whether giving χ^2 or reduced χ^2, always give $N_{\rm dof}$.

19) *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 \>.

20) *Equation numbering*. Although not obligatory, it is good practice to number all equations.

Even if you don't intend to refer to the equation elsewhere in the paper, other people might want to do so (e.g., the referee).

21) *Stokes parameters*. Since his name was "Stokes," write "Stokes Q," not "Stoke's Q."

22) *Spacing of exponents*. Now and then, depending on characters, exponents come out too close to the exponentiated symbol, e.g., ν^β. Space can be added with, e.g., `$\nu^{\,\beta}$`, giving $\nu^{\,\beta}$ or (better) `$\nu^{\hbox{\hglue 0.7pt}\beta}$`, giving ν^β, which makes it easy to "tune" the space.

23) *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 or 1.000.000) to separate thousands. Thin spaces (`\,`) should be used, giving $1\,000\,000$. *Never* simply type a space in the input file (`10 000`), as that would allow a line break in the middle of the number. Numbers with only 4 digits probably don't need a space – use common sense.

24) *Writing "σ"*. Write `5\,\sigma$` ($5\,\sigma$) or possibly `5\sigma` (5σ), but never `5-$\sigma$` (5-σ), and *especially* never `$5-\sigma$` ($5 - \sigma$).

25) *Derivatives.* Derivatives should be written with italic "d"s, e.g., dy/dx. A&A writes derivatives with roman "d"s, e.g., $\mathrm{d}y/\mathrm{d}x$, and will change $d \to \mathrm{d}$ in the proof stage. The reason for not following the A&A style is that the TeX input is more straightforward and less prone to error with italic "d"s, and the *Planck* papers will require fewer corrections in the final edit stage. A&A can then make the corrections uniformly.

16 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., `as described in \cite{planck2011-7.2}`, which becomes "as described in Planck Collaboration XX (2011)." Alternatively some sentences could refer to work (rather than a specific paper) "by the Planck Collaboration"; note that here "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

3) The bibliography style file `aat.bst` should be used, which will give full titles (helpful for distinguishing *Planck* papers) as well as arXiv hyperlinks in the reference list. This may require care over inclusion (and/or exclusion) of appropriate packages (e.g., `ifthen`); if there's a problem, follow what was done in a previous *Planck* paper.

4) 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.

SPIRES BibTeX entries for *Planck* papers should not be used at present, since they result in the author being "Ade et al." and do not include the identifying roman numerals. (We're trying to get this fixed, but in the meantime don't use them.)

5) 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`.

6) Use a consistent format for journal abbreviations, i.e., avoid having a mixture of "ApJ" and "Astrophys. J." Best practice is to use the built-in abbreviations, e.g., `\aap` for "A&A," `\apj` for "ApJ," and `\mnras` for "MNRAS."

17 FIGURES

17.1 General comments on figures

Figures in the cosmology and product papers must satisfy a much higher standard of quality and uniformity than was the case with the Early Results and earlier 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 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`).

Pay particular attention to the size of characters (Sect. 17.3.3) and extraneous white space around figures (Sect. 17.7.2). The most common problems in draft figures in the 2013 papers were in these two areas.

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).

17.2 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 realize 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."

In general, the first part of a caption should be a phrase ending with a period that functions as a title. This means that captions usually will *not* start with an article ("a" or "the"). However, there may be exceptions, and brevity should be the rule! Captions should certainly never start with "This figure shows ..."

17.3 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 section 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.

In some cases a "full width" figure will fit on the page better or look better at a smaller width than the 180 mm maximum set by the width of the printed page. For example, a full-page figure may be too tall to fit if its width is 180 mm. Start with 180 mm and adjust if it seems necessary.

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[†] 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 the text (i.e., LaTeX math fonts).

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.

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 180 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.

[†]   In the digital publishing world, $1\,\mathrm{pt} \equiv 1/72\,\mathrm{in} = 0.352\overline{7}\,\mathrm{mm}$.

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.

17.4 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). For more examples, and `IDL` and `Python` scripts that generate them, see Paperplots.pdf and associated scripts at

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

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 BOOME-RANG, 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 $(12\overset{\prime}{.}9 \pm 1\overset{\prime}{.}4)$ would shift the estimates (all up or all down together). The *black curve* is the joint model (see text).

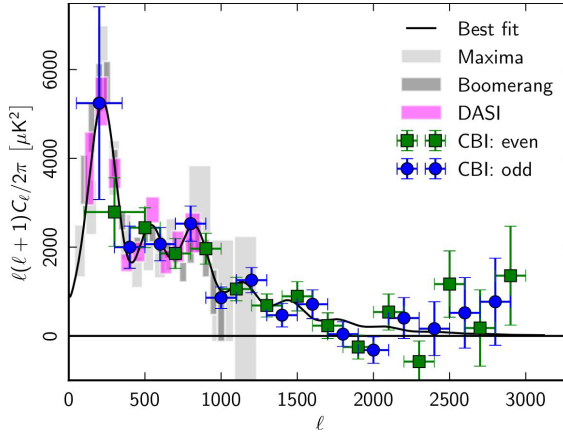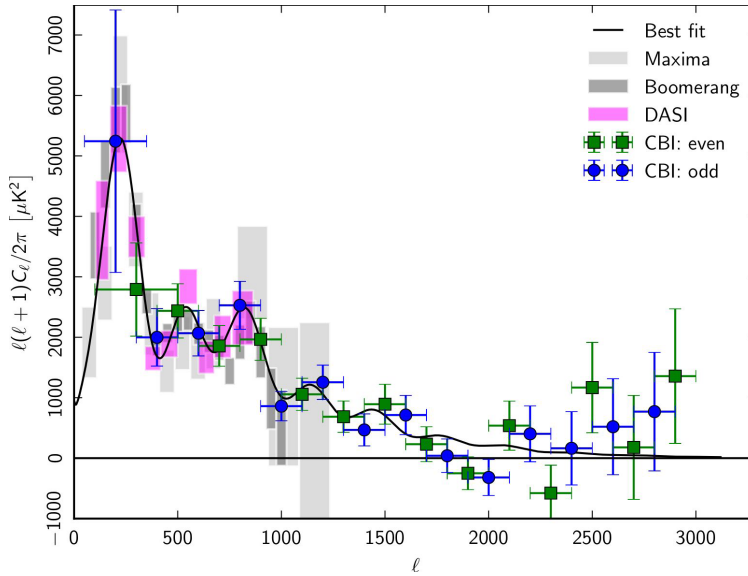FIG 2.—Figure 120 mm wide, with caption on the side.
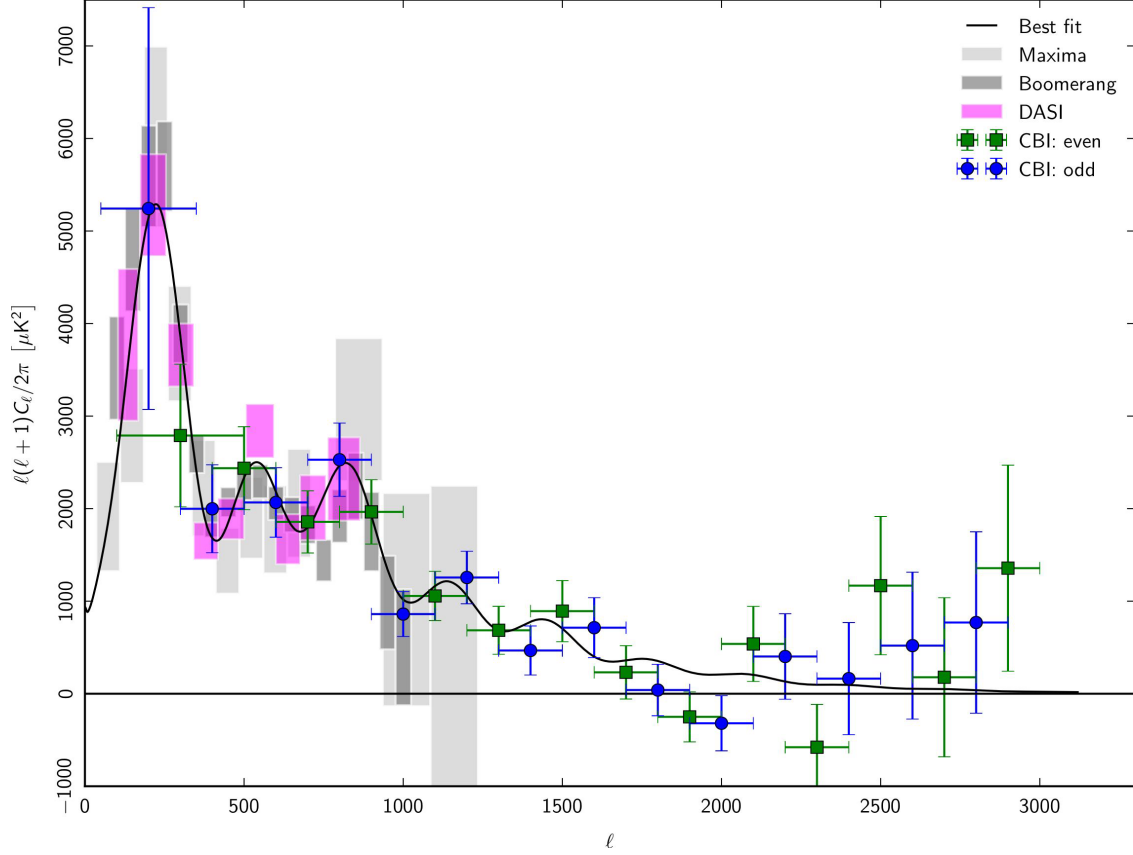
FIG 3.—Comparison of the joint power spectrum estimates from the three CBI mosaics with the measurements from BOOMERANG, DASI, and MAXIMA. The rectangles indicate the 68% confidence intervals on band-power; for BOOME-RANG, the solid rectangles indicate the 68% confidence interval for the statistical and sample variance errors, while the hatched rectangles show the amount by which a $\pm 1\sigma$ error in the beamwidth $(12\rlap.'9 \pm 1\rlap.'4)$ 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}
\end{figure*}

\begin{figure*} % Two-column figure
\includegraphics[width=18cm]{filename.eps}
\caption{\fcaption}
\label{fig2col}
\end{figure*}
```

17.5 Maps

Planck maps are in general "pseudocolour" maps, that is, they map intensity or another quantity onto a colour scale chosen to highlight the features of interest. Making a pseudocolour map of a quantity z involves the following steps.

Range. Choose the minimum and maximum values to display, z_1 and z_2 (values outside this range should be replaced by the minimum or maximum as appropriate, or replaced by an "undefined" value).

Transfer function. Apply a linear or nonlinear transformation to map the range from z_1 to z_2 to an integer range of colour indices (often 0 to 255; 256 different colour levels is usually sufficient, although a larger range can be useful in some cases if the software supports it). One very nonlinear transfer function is "histogram equalization;" while this may be useful for a first look at a map, it is only very rarely appropriate for publication.

Colour map. Choose colour values for each colour index (R, G, B or C, M, Y, K values). Choice of a colour map requires careful deliberation, depending on what features of the map are to be highlighted. "Undefined" or unmeasured pixel values should be indicated using a colour that does not appear in the colour map (e.g., white or grey).

One of three standard transfer functions should be used for most map figures.

- The transfer function/colour map used in figure 15 of *Planck 2013 results. I*. This is suitable for maps with low dynamic range and zero mean (e.g., the CMB).

- The transfer function/colour map used in figures 9 and 10 of *Planck 2013 results. I*. This is suitable for maps with high dynamic range and zero mean (e.g., the *Planck* frequency maps). It can be used for I, Q, and U maps at all frequencies (but note that different scalings are needed for the I maps at 545 and 853 GHz, which have different units).

- A one-sided version of the high dynamic range transfer function in the previous item, suitable for maps of polarization amplitude P or foregrounds, quantities which are inherently positive.

Details of these, with code for use in `IDL` and `Python`, can be found in Paperplots.pdf and the code repository (specify).

If the quantity being mapped is quite different, a completely different colour scheme to set it apart may be appropriate. For example, the "lensing potential map of the Universe" in the 2013 mission paper (Planck 2013 results. I.), figure 18. These should be discussed with the EB as early as possible to ensure consistency between papers. As far as possible, similar maps should be displayed using the same pseudocolour display across all papers.

Projection. Full-sky maps should normally be displayed in Mollweide projection in Galactic coordinates. Sky-patch maps should usually be displayed in the orthographic (tan) projection. When several patches are displayed together, they should be on the same scale (mm per degree) even if they cover different areas. Maps from different sources intended for direct comparison should always have the same sky coverage, scale, and projection; this is best achieved by plotting them with the same graphics program.

Resolution. Rendering a map for display on screen or paper involves repixelization. Typically the printer will use no more than 300 pixels per inch. Beware of information loss in this process. If the original `HEALPix` pixels are smaller than the print pixels, it is advisable to smooth the map before rendering. The visual effect of even mild smoothing can be dramatic. Any smoothing should be noted in the caption.

Annotation. Annotation should be added to the map image using a vector-based graphics program, preferably in a separate layer. All maps need proper annotation, including colour scale (always) and scale and location (except for the standard Mollweide all-sky view in Galactic coordinates centred on the Galactic centre). It should be possible to read off the sky location and pixel value.

The caption for a figure containing a map or maps should state clearly the source of the data (including the name of the file in the PLA when appropriate), the projection, and the coordinate system. For large-area maps in which the lines of longitude and latitude are strongly curved, a coordinate grid should be superimposed in the map. For small areas, it may be sufficient to label the coordinates around the edge. The colour bar should be labelled in such a way that the value corresponding to specific colour can be read off precisely. In general, and definitely for a nonlinear mapping, this requires more than just labelling the end points.

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

17.6 Requirements for figures with shading

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

17.7 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 ($> 300 \, \mathrm{pixels \, inch}^{-1}$) bitmap format such as TIFF. Do not use JPEG: it will blur the annotation.

2) *File sizes.* Giant files are awkward to deal with, and may make submission to the journal and the arXiv difficult. There is no specific limit to the number of MB in any particular file, but general guidelines are: not to use more pixels per inch than needed in images; and to apply (modest) JPEG compression if necessary (but do not apply JPEG compression to line drawings or to the annotation in images). As a specific example, it is not possible to represent all the information in an $N_{\mathrm{side}} = 2048$ image in a journal figure, so you shouldn't try. It may be a good idea to smooth images before downsampling them. Note also that PostScript is an inefficient format for figures; conversion to PDF will usually reduce the file size (without loss) quite effectively.

3) *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. If you have several figures that should all be displayed on the same scale, make sure they have identical bounding boxes. The Python and IDL scripts described and used in Paperplots.pdf and found at `http://github.com/zonca/paperplots/` show how to do this. As a last resort, white space can be cropped out one figure at a time with `Preview` on Apple computers (click on the dotted square in the tool bar, draw a box tight to the visible parts of the figure, copy, paste into a new file, and save) or with the "Document Setup/Edit Artboards" tool in `Illustrator`.

4) *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.*

5) *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. For example, `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 $12^{\mathrm{h}} \, 30^{\mathrm{m}}$ in the text or a table, do not use $187°\!.5$ in a figure!

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

7) *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_{det} [μK], Multipole order ℓ, or Length [mm]. However, if logarithms are involved, Log(length/mm) is preferable. Detector volts [V] is incorrect; it should be Detector reading [V] or possibly Detector voltage [V]. In labels as elsewhere (Sect. 10.8), use exponents, not fractions in units: $\text{km}\,\text{s}^{-1}$, not km/s. Don't use a dot to separate units ($\text{K}\,\text{km}\,\text{s}^{-1}$, not $\text{K.km}\,\text{s}^{-1}$). 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."

8) *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.

9) *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 pseudocolour 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).

10) *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.

11) *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.

12) *Time axes in days*. Time should be plotted in days rather than operational days (since 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.

13) *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.

14) *Mathematical symbols in figures*. Mathematical symbols in figures should match those in the text. Use TeX/LaTeX to make the symbols and paste them into the figure if necessary.

15) *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 introduced is unacceptable. The consequences are particularly undesirable for Mollweide projections, whose geometrical characteristics are ruined.

18 TABLES

18.1 General comments on 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 on how to use \halign to produce tables for *Planck* is given in Sect. 18.2. Before that, we list some things to do and not to do in tables.

1) Excessive numbers of digits should not be given. In general, the number of digits used for a quantity should be driven by the uncertainty on that quantity; in many cases a single digit on uncertainties is sufficient. We will follow the specific policy of the Particle Data Group, described on page 5 of

http://pdg.lbl.gov/2013/reviews/rpp2013-rev-rpp-intro.pdf,

which says "The basic rule states that if the three highest-order digits of the error lie between 100 and 354, we round to two significant digits. If they lie between 355 and 949, we round to one significant digit. Finally, if they lie between 950 and 999, we round up to 1000 and keep two significant digits. In all cases, the central value is given with a precision that matches that of the error. So, for example, the result 0.827 ± 0.119 would appear as 0.83 ± 0.12, while 0.827 ± 0.367 would turn into 0.8 ± 0.4."

There *may* be cases where using more precision is justified, e.g., when there is an important scientific point to make by comparing uncertainties. However, this should be the exception, and there should be a clear rationale for using increased numbers of digits.

2) In Sect. 15, item 4 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 the use of hyphens instead of minus signs in tables. **Don't do it!**

3) Footnotes in tables should be identified by roman superscript letters, which can be set with \tablefootmark{} and \tablefoottext{}. Better yet, make tables with \halign as described below starting in Sect. 18.2, and use the prescription given in Sect. 18.15.

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 those 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. A&A prefers the caption to be "as concise as possible so all additional description should be displayed in a footnote to the table." As you may have noticed in the 2013 results papers, the copy editors will change long captions to title phrases and put the rest in the

Table 2.
DECIMAL POINT ALIGNMENT

	30 GHz
Example 1	
$\Delta T_{30}\ [\mu\mathrm{K}]$	38.6 ± 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_{feeds}	1.2 ± 0.2

Notes. Since it's easier for us to check footnotes to tables if they are separate, and A&A will change to their preferred format at the end, follow the prescription for footnotes given in Sect. 18.15.

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 Sect. 18.9.

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 requires special attention is that of table values with asymmetrical errors (Table 3). Extra space in needed and easily obtained in this example with `\noalign{\vskip 4 pt}` between the lines (see Sect. 18.7).

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}
				Bad				
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	$0.9778^{+0.0002}_{-0}$	$2.43^{+0.02}_{-0.02}$	$2.10^{+0.01}_{-0.01}$	$1.3^{+1.8}_{-0.6}$	$1.3^{+1.3}_{-1.3}$	$3.1^{+1.6}_{-1.1}$	$1.6^{+0.3}_{-0.1}$	$2.03^{+0.14}_{-0.04}$
				Good				
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 third line produces 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**.

18.2 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).

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\,18.14 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*}
```

18.3 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
watermelons	brontosauruses	rutabagas
peaches	llamas	peas

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

18.4 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 Sect. 18.2,

```
\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
watermelons	brontosauruses	rutabagas
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
watermelons	brontosauruses	rutabagas
peaches	llamas	peas

Notice that the template line in the `\halign` command is broken into separate lines following the ampersands (`&`s). 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.

18.5 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&brontosauruses&rutabagas\cr
peaches&llamas&peas\cr
\noalign{\hrule}
}
```

apples	bears and mice	*yams*
oranges	elephants and mice	*corn*
watermelons	brontosauruses and mice	*rutabagas*
peaches	llamas and mice	*peas*

See Sect. 18.8 for more on rules after headings are introduced.

18.6 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=` $\dots$ then the default value of zero is used. The value of tabskip in effect when TEX 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

T_EX 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 T_EX 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

apples	bears and mice	*yams*
oranges	elephants and mice	*corn*
watermelons	brontosauruses and mice	*rutabagas*
peaches	llamas and mice	*peas*

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 considered good or bad (see comment about A&A and tables in Sect. 18.1), but you have no control over it in the A&A table style.

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

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

produces

apples	bears and mice	*yams*
oranges	elephants and mice	*corn*
watermelons	brontosauruses and mice	*rutabagas*
peaches	llamas and mice	*peas*

Much better!

18.7 Space between rows

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

```
{\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&brontosauruses&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&brontosauruses&rutabagas\cr
\noalign{\vskip 5pt}
peaches&llamas&peas\cr
\noalign{\hrule}
}
```

produces

apples	bears and mice	*yams*
oranges	elephants and mice	*corn*

| *watermelons* | brontosauruses and mice | *rutabagas* |
| *peaches* | llamas and mice | *peas* |

18.8 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

Fruits	**Animals**	**Vegetables**
oranges	elephants and mice	*corn*
watermelons	brontosauruses and mice	*rutabagas*
peaches	llamas and mice	*peas*

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

18.9 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
apples	bears and mice	*yams*
oranges	elephants and mice	*corn*
watermelons	brontosauruses and mice	*rutabagas*
peaches	llamas and mice	*peas*

18.10 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. Sect. 18.14 shows a better way, the one that is used in the `PlanckTable.tex` file.

18.11 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`.

18.12 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&
        \sl\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&brontosauruses&rutabagas\cr
\noalign{\vskip 4pt}
peaches&llamas&peas\cr
\noalign{\vskip 4pt\hrule}
}
```

produces

	Fruits & Animals	
Fruits	Animals	Vegetables
apples	bears and mice	*yams*
oranges	elephants and mice	*corn*
watermelons	brontosauruses and mice	*rutabagas*
peaches	llamas and mice	*peas*

18.13 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 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 2 in 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&44.5&$-34.0$&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

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

18.14 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 Sect. 18.12 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 need to use * or ! in a table, use ? or some other character not needed in the table 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 also be necessary to define a symbol to stand for the width of a decimal point or some other symbol used in the table.

18.15 Adding footnotes to a table

A&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&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}
```

In the LaTeX input file, it looks like this:
```
\setbox\tablebox=\vbox{\halign
%
% table stuff
%
}
\endPlancktable            % or \endPlancktablewide
\tablenote {{\rm a}} Whatever you want in tablenote ``a.''\par
```

That's it. Here's an example:
```
\centerline{\csc Assumed EVN Stations$^{\rm a}$}
\vskip -8pt
\setbox\tablebox=\vbox{
%
\newdimen\digitwidth
\setbox0=\hbox{\rm 0}
\digitwidth=\wd0
\catcode`*=\active
```

[†] 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`.

```
    \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 {{\rm 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

<div align="center">

Assumed EVN Stations[a]

</div>

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

[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.

Note that A&A prefers the footnote "letter" to be in a roman rather than italic font. Study the title line and what follows `\tablenote` in the example input file to see how to do this. The extra curly brackets are necessary. A&A also runs all the footnotes together in a single "**Notes:**" paragraph at the bottom of the table.

18.16 Paragraphs as table entries

Table entries sometimes are more or less like paragraphs. In such cases, you want TeX to choose line breaks and justify the margins. The way to do it is with a variant of putting things in \vboxes, as shown in the example below. A \vtop box is like a \vbox, except the top line of the \vtop box lines up with the entries in the other columns. If a \vbox had been used, the *bottom* line of the \vbox would have lined up with the entries in the other columns. Here's an example. TeX's ominous 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 now 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 \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 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.
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.
Entry 4	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.

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
```

APPENDIX A   Use of commas

Inserting commas can be helpful for making sentences readable. However, there are cases when it is wrong to use commas, for example, the following two phrases are both correct but mean different things:

> My brother, John, is 27.
>
> My brother John is 27.

The latter would be applicable if I had more than one brother and wanted to distinguish which one, the first if I had only one brother. More obviously,

> Let's eat Grandma.
>
> Let's eat, Grandma.

mean different things!!

Gowers's "Complete Plain Words" distinguishes "defining" and "commenting" clauses; there are no commas for defining clauses, but commas for commenting ones. The following example is given:

> Pilots, whose minds are dull, do not usually live long.

This is a defining clause, not a commenting one, and commas are incorrect in this case. In our field, we should distinguish, for example,

> The parameter n_s is poorly constrained

(a defining clause, giving which parameter) from

> The scalar power-law index, n_s, is poorly constrained

(a commenting clause, since "n_s" can be omitted without changing the meaning).

As a closing remark, Gowers also says "The use of commas cannot be learned by rule."