file: latex-bibtex-simple-manual.txt = introduction to latex and bibtex
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SIMPLE LATEX AND BIBTEX INSTRUCTION FOR ASTRONOMY STUDENTS

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This simple latex and bibtex tutorial tells you how to write a report
that will be closely similar in appearance to A&A and ApJ papers, and
is easily modified into an A&A or ApJ manuscript.

There are parallel txt, pdf, and html versions of this manual at
   http://www.staff.science.uu.nl/~rutte101/Manuals.html
The html and pdf versions have active weblinks.

This manual was initially written for second-year astronomy students
at Utrecht University doing the "Stellar Spectra" exercises at
   http://www.staff.science.uu.nl/~rutte101/Exercises.html

Startup

 - begin by getting and unzipping file
     studentreportfiles.zip
   at
   http://www.staff.science.uu.nl/~rutte101/rrweb/rjr-edu/manuals/student-report

   to obtain the example LaTeX input file
     example.tex
   the associated BibTeX database file
     example.bib
   and the associated figure
     waterfalls.ps waterfalls.pdf

   You may also need to have style files
     aa.cls
     aa.bst
     txfonts.sty
     twoopt.sty
   which normally reside in a separate directory that LaTeX and BibTeX
   can find by themselves. If you don't know how to set the search

path then put these also in your report writing directory.

- you may use latex etc commands in a terminal (Unix/Linux/MacOS)
  or use a more elaborate interface as Texmaker, TeXworks, WinEdt,
  TeXShop, Latexian, Texpad, etc.
  Process the example file example.tex to see what it does:
    latex - bibtex - latex - latex - inspection
  using Adobe Reader for the latter. Print from the Adobe print menu.

- under Unix/Linux/MacOS in a terminal or with auctex from emacs:

```
latex example     # warns about undefined citations and references
latex example     # only undefined citations; figure references OK
bibtex example    # uses example.aux to make example.bbl from example.bib
latex example     # puts refs from example.bbl into the .aux file
latex example     # no complaints anymore: done
xdvi example &    # .dvi preview; click to refresh after text changes
  and when you are done
dvips -z example -o example.ps    # produce PostScript output
gv example.ps                     # inspect PostScript output
lpr -Pprintername example.ps      # print PostScript output
ps2pdf -dUseCIEColor=true -dPDFSETTINGS=/printer example.ps  # make pdf
pdflatex example          # also makes a pdf but needs .pdf figures
acroread example.pdf &    # inspect pdf output; print from menu
```

- inspect the input file example.tex and the output and study in
  detail how the former generates the latter.

Template

- file template.tex is the same as example.tex but without textual
  content. Copy it into a new file XXXX.tex to start a new report.

- a template for Astronomy and Astrophysics (A&A) papers is easily
  made by replacing my header stuff by the pertinent A&A commands
  (\title, \author, \titlerunning, \institute, \date, \offprints,
  \abstract, \keywords and \maketitle). The rest remains the same.

- a template for Astrophysical Journal (ApJ) papers is easily made by
  replacing the aa.cls and aa.bst files by the ApJ styles and the
  header stuff by the ApJ commands. The rest remains the same.
  Unfortunately, IOP's processing does not retain ADS-clicker citations.

LaTeX text typing (check this most carefully! Make it habits!)

```
- use WinEdt or a Unix/Linux/MacOS editor to type the latex input text
  (Emacs has special features and hooks for LaTeX and BibTeX).
  Type pure ASCII: generate accents etc with LaTeX \ commands.
  Good typing habits:
   - indent equations and environments as in programming
   - add comments to clarify your layout and what you are doing
     (LaTeX skips the remainder of a line after %, type \% to get %)
   - consider starting each new sentence on a new line (in Emacs this
     can be automated with the .emacs settings at
  http://www.staff.science.uu.nl/~rutte101/Recipes_linux_unix_MacOSX.html

- new paragraph = 1 or more blank lines, not ....\\[1ex]

- spaces:
    multiple spaces is the same as a single space
    no-line-break-space: ~      R.J.~Rutten,   1083.0~nm line
      (otherwise you may get the unit nm on the next line)
    code space after period after small character: Prof.\ Dr.\ C.~Zwaan
      (otherwise LaTeX adds more space taking it to be end of a sentence)
    code space after LaTeX command: 4554~\AA\ line, but \AA. Nordlund
      (otherwise LaTeX eats up the space as command delimiter)

- dashes: hyphen = -            magneto-acoustic
          longer dash = --      5--min oscillation
          longest dash =  ---   he said---but I think (ApJ habit)
                                he said -- but I think (A&A habit)

- quotation marks: use ``......'', never "...."

- mathematics:
    $...$ for in-text math
    never use \frac in in-text math (too small), use $a/b$ instead
    \begin{equation}
       ........         for displayed & numbered equation (indent!)
       \label{eq:whatever}
    \end{equation}
    Use \sin, \cos, \exp  etc   ($sin$ means product s i n)
    Use roman alphabet for non-mathematical indices
      (code only math variables in math notation ($x$), cf. A&A manual):
       $T_{\rm eff}$
              ($T_{eff}$ makes eff = product e, f and f)
       \begin{equation}
          B_\nu(T) = \frac{2\pi m_{\rm e} c^2}{h^3}
               %% e = electron
                     \frac{1}{\exp{-h\nu/kT}-1}
          \label{eq:Planck}
       \end{equation}
    Use {\rm d} or \partial for differential d
```

```
    Add thin space with \, before differential d, {\rm e}^{..} etc
    Shrink space: for the $n\!=\!2$ level
    Add punctuation after equations, just as in normal text

- numbers and units:
    $B_\nu = 5\,10^{12}$~erg\,cm$^{-2}$\,s$^{-1}$\,sterad$^{-1}$
    $v=50$~km\,s$^{-1}$ velocity
    180~s  10~mHz
    a $40 \times 30$~arcsec$^2$ field
  alternative is to use smaller blank space with \,:
    50\,km\,s$^{-1}$ velocity
    the Ba\,II\,4554\,\AA\ line (NB: the \ after \AA to get a normal space)
    10\,mHz frequency
    at $\lambda \approx 160$\,nm one observes

- crossreferences:
    make all references to figures, tables, equations, sections
    dynamic by adding labels to them:
      \label{fig:power images}
      \label{tab:lines}
      \label{eq:mass conservation}
      \label{sec:discuss}
    and refering to these as:
      in Section~\ref{sec:discuss} we discuss
      Figure~\ref{fig:power images} shows power spectra
      (see Figs.~\ref{fig:xx}, \ref{fig:xx}---\ref{fig:xx})
      inserting this result into eq.~(\ref{eq:mass conservation})
    NB: LaTeX needs to be run twice to get all crossreferences right.

- literature citations and references:
  Most astronomers and astronomy journals use the name-year system:
  .... by Rutten and Schrijver (1994)
         (see Schrijver, 1993e; Rutten, 1993).
  .... (cf.\ Rutten \& Schrijver 1994)
  but Nature and some others use numbered references.
  See example.tex and below for automatic reference generation with BibTeX.
```

LaTeX processing

When your XXXX.tex file is done or half done, process it as the example file above (latex - latex - bibtex - output) and inspect the output.

LaTeX errors are usually due to unmatched pairs of $$, {}, \begin and \end. I often mistakenly type $ for & in tables.

If you don't like the layout, do not try local solutions such as ad-hoc white space, but adapt the formats by more general commands at the start of your file. You may feel that LaTeX confines you to overly restrictive straightjackets. Then switch to TeX ("the sportscar engine under the hood of the LaTeX sedan") - but first ask yourself whether you want to be a professional typesetter or a professional astronomer. For astronomical papers you need to adhere strictly to the style of the publisher. They have chosen LaTeX in order to fix the layout their way without bothering you or being bothered by you. So don't try to re-invent the wheel!

When you are happy with what the previewer shows:

```
aspell -t --dont-check-cmments check XXXX.tex     # check for typos
aspell -t -d british --dont-tex-check-comments check XXXX.tex   # in UK
latex XXXX                                        # final version
```

To clean your working directory from all the LaTeX auxiliary files, you might in Unix/Linux/MacOS define a command like:

```
alias rmtex 'rm *.aux *.dvi *.lis *.log *.blg *.bbl *.toc'
```

The text.tex file and the figure.ps (or .eps or .pdf) files are the only ones which you need to keep. They regenerate all others.

References

- my example.tex file closely copies habits of A+A. The references are formatted in the style used by A&A and ApJ, as defined in Bibtex style file aa.bst (or my adsaa.bst modification). For other journals hunt the web for an appropriate XXX.bst bibstyle file.

- the corresponding BibTeX input file example.bib has the necessary BibTeX "items" copied directly from ADS
  http://adsabs.harvard.edu/default_service.html
  which has a clicker supplying these underneath every abstract. But sometimes, especially for proceedings publications, you need to improve the ADS entry.

- the example file uses my \citeads citation commands. These turn the in-text citation into a clicker that opens the corresponding ADS abstract page in your browser (if your Adobe Reader [acroread] setup permits internet access. This is an option under Edit > Preferences > Trust Manager > Change Settings that Adobe seems to have defaulted off on the advice of the infamous NSA in 2013). Such opening is convenient in on-screen reading because it shows the cited paper in parallel to one's reading, without jump to the reference list. These commands require that you use separate \citeads commands per cited paper using its ADS label. This trick

survives in the A&A production process and is recommended by A+A.
It also survives in the pdf generation by arXiv (Astroph). I don't
know whether it survives the non-latex production of ApJ by IOP.
In addition, my adsaa.bst modification of aa.bst adds the ADS codes
to the references. These are also clickable and may be useful to
hyperlink-challenged printed-paper readers.
Note added May 12 2014: I now use a newer texlive installation
in which these \citeads macros generate non-fatal error
warnings: "Illegal parameter number in definition of \Hy@temp"
when calling latex (but not when calling pdflatex).
I haven't found a proper correction yet and therefore added a fix
making latex not stop at error messages within these \citeads
commands.

- in my own writing I use automatic scripts to download all the
abstracts and corresponding BibTeX items for all publications by
all my colleagues. I so maintain my own abstract collection, see
http://www.staff.science.uu.nl/~rutte101/Solar_physicist_abstract.html

While writing I simply copy the ADS bibcode found in these
abstracts into a \citeads command into my manuscript LaTeX file, and
let BibTeX find the corresponding reference info by searching the
whole database. See:
http://www.staff.science.uu.nl/~rutte101/Recipes_bibtex.html

Figures
=======

- figure location: I keep my figure files in a subdir \figs per paper.

- layout: keep your figures small but make their labeling large. Aim
at vertical panel stacking for A&A manuscripts or other
column-style publications. Often you should remove the axis
annotation between adjacent same-scale panels to gain space.

- multipanel figures: I do not make multipanel figures in IDL (a
hassle) but prepare standalone figures with full axis annotation
for each panel in IDL and then do the multi-panel assembly in
latex, stripping off the axis annotation where desired. The
advantage of this approach is that I can choose between page-wide
horizontal or column-high vertical panel assembly depending on
how the paper layout comes along, while I am writing it. Without
bothering co-authors that have contributed figures. I do such
assembly using my self-explanatory template file
http://www.staff.science.uu.nl/~rutte101/rrweb/rjr-edu/manuals/student-report/cutmulti

- color: usually too expensive for publication on paper but fine for
    web distribution. Remember that red-green color blindness is
    quite common (7-10% of all males).

- figure location: you have to find by trial where to stick a
    particular {figure} environment in your LaTeX input file to get
    it to a suitable location in the output. It comes at or after
    the insert location in your text, not before. The same holds for
    other "floats" such as tables. Always have figures and tables
    surrounded by blank lines in your input xxx.tex file.

- figure clipping:
    \includegraphics[bb = 11 278 408 544,width=88mm,clip]
    where the four numbers are the x and y of the lower-left
    and upper-right corners of the cutting box in bp units. You can
    measure these manually with Ghostview, in Unix/Linux/MacOS with
       gv figure.ps
    which displays the cursor position in bp units at the upper left.

- figure stealing in Adobe Reader:
   - open the pdf file
   - click on the "graphic select tool" button
   - draw cutout rectangle
   - right mouse button: print
   - print menu: selected graphic on; save to file figure.ps
   - cut bounding box: see below

- figure stealing in MacOS:
   - open the pdf file with open -a Preview file.pdf
   - click on the "graphic select tool" button
   - draw cutout rectangle
   - Apple C, Apple N
   - file menu: save to file figure.pdf

- figure conversion ps, eps, pdf in Unix/Linux/MacOS:
    ps2eps file.ps   # cut the bounding box, but it can misfire
    ps2epsi file.ps   # idem, sometimes better
    epstopdf file.ps   # convert ps or eps into pdf
    pdfcrop file.pdf   # cut figure to its actual bonding box (no white)
    pdfcrop --margins "5 5 5 5" file.pdf   # idem with small white margin

- figure conversion to .png for presentation displays in Unix/Linux/MacOS:
    I use script
      #!/bin/csh
      epstopdf $1
      pdfcrop --margins 5 $1:gr.pdf
      convert -density 400 -geometry 1024x768 -background white -flatten $1:gr-crop.pdf
      rm -f $1:gr.pdf $1:gr-crop.pdf

```
    and I may annotate the png product with the reference through
    a similar script with entries:
      pdfcrop --margins "5 20 5  5" $2:gr.pdf
      convert -density 400 -geometry 1024x768 -background white -flatten -font "-misc-fi

 - ps figure conversion to smaller file size (when they have too much detail,
   for example scatter plots, or for arXiv) with Unix/Linux/MacOS script:
     #!/bin/csh
     epstopdf $1
     pdfcrop $1:gr.pdf
     convert -density 500 -geometry 3000x2000 -background white -flatten
       $1:gr-crop.pdf  $1:gr.jpg
     jpeg2ps -h $1:gr.jpg > small-$1:gr.eps
     rm -f $1:gr.pdf $1:gr-crop.pdf $1:gr.jpg


Other manuals
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 - Leslie Lamport's original latex book remains one of the best
   manuals ever written.  It is the only printed manual which I still
   use (I Google any other software question).  Usually I look up a
   final Part-C entry in the index to check the complete definition.

 - the "LaTeX Companion" book offers many tricks but most are not
   needed by astrophysicists.  Electronic version for sale at:
   http://www.latex-project.org/guides/books.html#latex-english


 - Google <latex manual> <simple latex manual> delivers many good
   to excellent manuals.

 - Google <A&A> leads you to the A&A website with extensive writing
   instructions for A&A papers.

 - Google <ApJ> leads you to an ApJ website which directs you to the
   AASTeX instructions and macros for ApJ manuscript preparation.

 - Natbib reference sheet:
   http://merkel.zoneo.net/Latex/natbib.php
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