The HEP-PAPER package*

Publications in high energy physics

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Abstract

The HEP-PAPER package aims to provide a single style file containing most configurations and macros necessary to write appealing publications in High Energy Physics. Instead of reinventing the wheel by introducing newly created macros HEP-PAPER preferably loads third party packages as long as they are lightweight enough.

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1 Introduction

For usual publications it is enough to load additionally to the article class without optional arguments only the hep-paper package [1].

\documentclass{article}
\usepackage{hep-paper}

The most notable changes after loading the hep-paper package is the change of some \LaTeX\ defaults. The paper and font sizes are set to A4 and 11 pt, respectively. Additionally, the paper geometry is adjusted using the geometry package [2]. Furthermore, the font is changed to latin modern using the cfr-lm package [3] with microtype [4] optimizations. Finally, portable document format (PDF) hyperlinks are implemented with the hyperref package [5]. If only subset of the functionality is needed one of the smaller style files hep-title, hep-acronyms, and hep-bibliography containing only the macros relevant to sections 2.1, 2.2.2, and 2.5, respectively.

1.1 Options

paper The paper=(format) option loads the specified paper format. The possible (formats) are: a0, a1, a2, a3, a4, a5, a6, b0, b1, b2, b3, b4, b5, b6, c0, c1, c2, c3, c4, c5, c6, ansia, ansib, ansic, ansid, letter, executive, legal. The default is a4.

font The font=(size) option loads the specified font size. The possible (sizes) are: 8pt, 9pt, 10pt, 11pt, 12pt, 14pt, 17pt, 20pt. The default is 11 pt.

lang The lang=(name) option switches the document language to one of the values provided by the babel package [6]. The default is british.

sansserif The sansserif option switches the document including math to sans serif font shape.

oldstyle The oldstyle option activates the use of oldstyle text- (123) in favour of lining- (123) figures in text mode.

parskip The parskip option changes how paragraphs are separated from each other using the parskip package [7]. The \LaTeX\ default is separation via indentation the parskip option switches to separation via vertical space.\footnote{Although the parskip option is used for this document, it is recommended only for very few document types such as technical manuals or answers to referees.}

symbols The symbols=(family) set the family of the symbol fonts. symbols=ams loads the two AMS fonts [8] and the \texttt{bm bold} fonts. The default symbols=true replaces additionally the blackboard font with the dsfont [9]. symbols=minion switches the symbol fonts to the Adobe MinionPro companion font from the MnSymbol package [10]. symbols=false deactivates loading any additional symbol fonts.

1.1.1 Deactivation

The hep-paper package loads few bigger packages which have a large impact on the document. The deactivation options can prevent such and other adjustments.
The `defaults` option prevents the adjustment of the page geometry and the font size set by the document class.

The `title=false` option deactivates the title page adjustments.

The `bibliography=⟨key⟩` option prevents the automatic loading of the `biblatex` package [11] if ⟨key⟩=false. Otherwise the ⟨key⟩ is passed as style string to the `biblatex` package.

The `glossaries=false` option deactivates acronyms and the use of the `glossaries` package [12].

The `references=false` option prevents the `cleveref` package [13] from being loaded and deactivates further redefinitions of reference macros.

### 1.1.2 Compatibility

The compatibility options activate the compatibility mode for certain classes and packages used for publications in high energy physics. They are mostly suitable combinations of options described in the previous section. If `hep-paper` is able to detect the presence of such a class or package, i.e. if it is loaded before the `hep-paper` package, the compatibility mode is activated automatically.

The `beamer` option activates the `beamer` [14] compatibility mode.

The `jhep` option activates the JHEP [15] compatibility mode.

The `jcap` option activates the JCAP [16] compatibility mode.

The `revtex` option activates the REVTEX [17] compatibility mode.

The `pos` option activates the PoS compatibility mode.

The `springer` option activates the compatibility mode the `svjour` class [18].

### 1.1.3 Reactivation

The `hep-paper` package deactivates unrecommended macros, which can be reactivated manually.

The `manualplacement` option reactivates manual float placement.

The `eqnarray` option reactivates the depreciated `eqnarray` environment.

### 2 Macros and environments

If the global `twocolumn` option is present the page geometry is changed to cover almost the entire page. Additionally the `abstract*` environment is defined that generates a one column abstract and takes care of placing the title information.
2.1 Title page
\series The \series{(series)} macro is defined using the \texttt{titling} package [19].
\title The PDF meta information is set according to the \title{(text)} and \author{(text)} information.
\subtitle The \subtitle{(subtitle)} macro is defined.
\editor In order to facilitate multiple authors with different affiliations the \texttt{authblk} package is loaded. The following lines add e.g. two authors with different affiliations
\affiliation \author[1]{Author one \email{email one}} \affiliation[1]{Affiliation one}
\email \author[2]{Author two \email{email two}} \affiliation[1,2]{Affiliation two}
\preprint The \preprint{(numeri)} macro places a pre-print number in the upper right corner of the title page.
\abstract The \texttt{abstract} environment is adjusted to not start with an indentation.
\titlefont Various title font macros are defined, allowing to change the appearance of the \texttt{maketitle} output.
\subtitlefont
\authorfont
\affiliationfont
\preprintfont
\enquote
\MakeOuterQuote
\eg
\vs
\no
\software The \software{version}{name} macro is typeset as HEP-PAPER v1.7.
\online The \online{url}{text} macro combines the features of the \href{url}{text} [5] and the \url{text} [23] macros, resulting in e.g. \texttt{ctan.org/pkg/hep-paper}.
\inlinelist The \inlinelist and \texttt{enumdescipt} environments are defined using the \texttt{enumitem} package [24].
\enumdescription
The three main points are
\begin{inlinelist}
\item one
\item two
\item three
\end{inlinelist}
\begin{enumerate}
\item First one
\item Second two
\item Third three
\end{enumerate}

A bold version of \textsc{Small Caps} and a sans serif version of \textsc{Small Caps} based on the computer modern font [25] is provided, the latter using the \texttt{sansmathfonts} package [26].

The \texttt{underline} macro is redefined to allow line-breaks using the \texttt{ulem} package [27]. The \texttt{overline} macro is extended to also \underline{overline} text outside of math environments.

If the \texttt{parskip} option is activated the \texttt{useparindent} macro switches to the usual parindent mode, while the \texttt{useparskip} macro switches to the parskip mode.

\subsection*{2.2.1 References and footnotes}

\texttt{\cref} References are extended with the \texttt{cleveref} package [13], which allows to \textit{e.g.} just type \texttt{\cref{(key)}} in order to write ‘figure 1’. Furthermore, the \texttt{cleveref} package allows to reference multiple objects within one \texttt{\cref{(key1,key2)}}.

\texttt{\cite} Citations are adjusted to not start on a new line in order to avoid the repeated use of \texttt{-\cite{(key)}}.

\texttt{\ref} References are also adjusted to not start on a new line.

\texttt{\eqref} Footnotes are adjusted to swallow white space before the footnote mark and at the beginning of the footnote text.

\texttt{\footnote} Footnotes are adjusted to swallow white space before the footnote mark and at the beginning of the footnote text.

\subsection*{2.2.2 Acronyms}

\texttt{\acronym} The \texttt{\acronym} macro generates the singular \texttt{(abbreviation)} and plural \texttt{(abbreviation)s} macros. The first star prevents the addition of an ‘s’ to the abbreviation plural. The second star restores the \TeX{} default of swallowing subsequent white space. The long form is only shown at the first appearance of these macros, later appearances generate the abbreviation with a hyperlink to the long form. The long form is never used in math mode. Capitalization at the beginning of paragraphs and sentences is (mostly) ensured. The \texttt{\shortacronym} and \texttt{\longacronym} macros are drop-in replacements of the \texttt{\acronym} macro showing only the short or long form of their acronym. The first use form of the acronym can be enforced by resetting the acronym counter with \texttt{\resetacronym{(key)}}. If the acronym counter equals one at the end of the document the short form of the acronym is not introduced. Placing a \texttt{\dummyacronym{(key)}} at the end of the document ensures that the short form is introduced.
2.3 Math

The \texttt{mathtools} \cite{mathtools} and \texttt{amssymb} \cite{amssymb} packages are loaded. They in turn load the \texttt{AMaTeX} \texttt{amsmath} \cite{amsmath} and \texttt{amsfonts} \cite{amssymb} packages. Bold math, via \texttt{\mathbf} is improved by the \texttt{bm} package \cite{bm}. Macros switching to \texttt{bfseries} such as \texttt{\section{(text)}} are ensured to also typeset math in bold. The \texttt{\text{(text)}} macro makes it possible to write text within math mode, \textit{i.e.} \,(Ab\Gamma\delta Ab\Gamma\delta). The \texttt{\mathsans} font is improved by the \texttt{mathfrak} \cite{mathfrak} package \cite{mathfrak}. Bold math, via \texttt{\mathbf} is improved by the \texttt{bm} package \cite{bm}, \textit{i.e.} \,(Ab\Gamma\delta Ab\Gamma\delta). The \texttt{\text{⟨text⟩}} macro makes it possible to write text within math mode, \textit{i.e.} \,(Ab\Gamma\delta Ab\Gamma\delta). The \texttt{\mathsf} math sans serif alphabet is redefined to be italic sans serif if the main text is serif, \textit{i.e.} \,(Ab\Gamma\delta Ab\Gamma\delta). The \texttt{\mathcal} font is \textit{i.e.} \,(Ab\Gamma\delta Ab\Gamma\delta). The \texttt{\mathbb} font is improved by the \texttt{doublestroke} \cite{doublestroke} package \cite{doublestroke} and adjusted depending on the \texttt{sansserif} option \textit{i.e.} \,(Ah1). Finally, the \texttt{\mathfrak} font is also available \textit{i.e.} \,(Ab\Gamma\delta Ab\Gamma\delta). Details about the font handling in \TeX{} can be found in reference \cite{mathfonts}.

The \texttt{\frac{⟨number⟩}{⟨number⟩}} macro is accompanied by \texttt{\nicefrac{⟨number⟩}{⟨number⟩}}, \texttt{\textfrac{⟨number⟩}{⟨number⟩}}, and \texttt{\flatfrac{⟨number⟩}{⟨number⟩}} leading to $\frac{1}{2}$, $\frac{1}{2}$, $\frac{1}{2}$, and $\frac{1}{2}$. Diagonal matrix \texttt{\diag} and signum \texttt{\sgn} operators are defined.

\texttt{\mathdef{⟨name⟩}{⟨arguments⟩}{⟨code⟩}} macro (re-)defines macros only within math mode without changing the text mode definition.

The imaginary unit \texttt{i} and the differential \texttt{d} are defined using this functionality.

For longer paper it can be useful to re-number the equation in accordance with the \texttt{section} numbering \texttt{\numberwithin{equation}{section}}. In order to further reduce the size of equation counter it can be useful to wrap \texttt{\align} environments with multiple rows in a \texttt{subequations} environment. Both macros are provided by the \texttt{AMaTeX} package.

The depreciated \texttt{eqnarray} environment is undefined as long this behaviour is not prevented by the \texttt{eqnarray} package option. The \texttt{split}, \texttt{multline}, \texttt{align}, \texttt{multlined}, \texttt{aligned}, \texttt{alignedat}, and \texttt{cases} environments of the \texttt{AMaTeX} and \texttt{mathtools} packages should be used instead.

\texttt{\equation} Use the \texttt{\equation} environment for short equations.

\begin{equation}
\begin{array}{c}
\text{left} = \text{right} \\
\end{array}
\end{equation}

Use the \texttt{\equation} environment for long equations.

\begin{multline}
\begin{array}{c}
\text{left} = \text{right 1} \\
+ \text{right 2} \\
\end{array}
\end{multline}

Use the \texttt{\split} sub environment for equations in which multiple equal signs should be aligned.
\begin{align} 
left &= right_1 \\
left &= right_2
\end{align} \quad \text{(3)}

align  
Use the \texttt{align} environment for the vertical alignment and horizontal distribution of multiple equations.

\begin{align} 
left &= right_1, \\
left &= right_2, \\
left &= right_3, \\
left &= right_4
\end{align} \quad \text{(4a)}

\begin{align} 
left &= right_1, \\
left &= right_2, \\
left &= right_3
\end{align} \quad \text{(4b)}

aligned  
Use the \texttt{aligned} environment within a \texttt{equation} environment if the aligned equations should be labeled with a single equation number.

\begin{alignat}{2} 
left &= long right, & \\
le. 2 &= ri. 2, & \\
\mathllap{le. 3} &= ri. 3
\end{alignat} \quad \text{(5)}

multlined  
Use the \texttt{multlined} environment if either \texttt{split} or \texttt{align} contain very long lines.

\begin{align} 
left &= right_1 \ , \ & \\
\begin{multlined}[t] right_2 \ + right_3 \ \\
\end{multlined}
\end{align} \quad \text{(5)}

alignat  
Use the \texttt{alignat} environment together with the \texttt{\mathllap} macro for the alignment of multiple equations with vastly different lengths.

\begin{align} 
\begin{alignat}{2} 
left &= long right, & \\
\mathllap{le. 2} &= ri. 2, & \\
\mathllap{le. 3} &= ri. 3
\end{alignat}
\end{align} \quad \text{(6a)}

As a rule of thumb if you have to use \texttt{\notag}, \texttt{\nonumber}, or perform manual spacing via \texttt{\quad} you are probably using the wrong environment.

\subsection{Physics}

\texttt{\unit}  
The correct spacing for units, \textit{cf.} equation (7), is provided by the macro \texttt{\unit\{value\}} \texttt{\{unit\}} from the \texttt{units} package [32] which can also be used in text mode. The macro \texttt{\inv\{power\}\{text\}} allows to avoid math mode also for inverse units such as 5 fb\textsuperscript{-1} typeset via \texttt{\unit[5]{\inv{fb}}}.

Greek letters are adjusted to always be italic and upright in math and text mode, respectively, using the \texttt{fixmath} [33] and \texttt{alphabeta} [34] packages. This allows differentiations like

\begin{equation} 
\sigma = 5 \text{ fb} , \quad \text{at } 5 \sigma \text{ C.L.} , \quad \mu = 5 \text{ cm} , \quad l = 5 \mu \text{ m} , \quad \text{(7)}
\end{equation}
\begin{panels}{2}
\begin{tabular}{cccc}
one & two \\
\begin{panel}
\begin{tabular}{cccc}
a & b & c & d \\
b & c & d \\
\end{tabular}
\end{panel}
\end{tabular}
\end{panels}

(a) Code for this panel environment. (b) The \texttt{booktabs} and \texttt{multirow} features.

Table 1: Example use of the \texttt{panels} environment in Panel (a) and the features from the \texttt{booktabs} and \texttt{multirow} packages in Panel (b).

\[ \langle \phi \rangle , \quad \frac{\partial^n f}{\partial x^n} , \quad [A, B] , \quad \mathcal{O}(x^2) , \quad x|_0^\infty , \quad \det(M) . \quad (8) \]

The \texttt{physics} package [35] provides additional macros such as

\begin{align*}
\quad \texttt{\textbackslash ev} & \quad \text{The } \texttt{physics} \text{ package [35] provides additional macros such as} \\
\quad \texttt{\textbackslash pdv} & \quad \langle \phi \rangle , \quad \frac{\partial^n f}{\partial x^n} , \quad [A, B] , \quad \mathcal{O}(x^2) , \quad x|_0^\infty , \quad \det(M) . \quad (8) \\
\quad \texttt{\textbackslash comm} & \quad \text{The } \texttt{cancel\{}(\text{characters})\texttt{\}} \text{ macro from the } \texttt{cancel} \text{ package [36] and the } \texttt{slashed\{}(\text{character})\texttt{\}} \text{ macro from the } \texttt{slashed} \text{ package [37] allow to cancel math and use the} \\
\quad \texttt{\textbackslash cancel} & \quad \text{Dirac slash notation i.e. } \partial, \text{ respectively.} \\
\quad \texttt{\textbackslash slashed} & \quad \text{A better looking over left right arrow is defined i.e. } \overleftarrow{\partial}. \\
\quad \texttt{\textbackslash order} & \quad \text{A better looking over left right arrow is defined i.e. } \overleftarrow{\partial}. \\
\quad \texttt{\textbackslash cancel\{}(\text{characters})\texttt{\}} & \quad \text{The } \texttt{cancel\{}(\text{characters})\texttt{\}} \text{ macro from the } \texttt{cancel} \text{ package [36] and the } \texttt{slashed\{}(\text{character})\texttt{\}} \text{ macro from the } \texttt{slashed} \text{ package [37] allow to cancel math and use the} \\
\quad \texttt{\textbackslash slashed} & \quad \text{Dirac slash notation i.e. } \partial, \text{ respectively.} \\
\quad \texttt{\textbackslash order} & \quad \text{A better looking over left right arrow is defined i.e. } \overleftarrow{\partial}. \\
\end{align*}

\[ \quad \texttt{\textbackslash overleftright} & \quad \text{A better looking over left right arrow is defined i.e. } \overleftarrow{\partial}. \]

\subsection{2.4 Floats}

\[ \quad \texttt{\textbackslash figure} & \quad \text{Automatic float placement is adjusted to place a single float at the top of pages and} \\
\quad \texttt{\textbackslash table} & \quad \text{to reduce the number of float pages, using the \LaTeX macros.} \\
\quad \texttt{\textbackslash setcounter{bottomnumber}{0}} & \quad \text{no floats at the bottom of a page (default 1)} \\
\quad \texttt{\textbackslash setcounter{topnumber}{1}} & \quad \text{a single float at the top of a page (default 2)} \\
\quad \texttt{\textbackslash setcounter{dbltopnumber}{1}} & \quad \text{same for full widths floats in two-column mode} \\
\quad \texttt{\textbackslash renewcommand{\textfraction}{.1}} & \quad \text{large floats are allowed (default 0.2)} \\
\quad \texttt{\textbackslash renewcommand{\topfraction}{.9}} & \quad \text{large floats are allowed (default 0.7)} \\
\quad \texttt{\textbackslash renewcommand{\dbltopfraction}{.9}} & \quad \text{large floats are allowed (default 0.7)} \\
\quad \texttt{\textbackslash renewcommand{\textfraction}{.8}} & \quad \text{float pages must be full (default 0.5)} \\
\end{align*}

Additionally, manual float placement is deactivated but can be reactivated using the \texttt{manualplacement} package option. It is however recommended to archive the desired design by adjusting above macros. The most useful float placement is usually archived by placing the float \textit{in front of} the paragraph it is referenced in first. The float environments have been adjusted to center their content. The usual behaviour can be reactivated using \texttt{raggedright}.

\[ \quad \texttt{\textbackslash panels} & \quad \text{The } \texttt{panels} \text{ environment makes use of the } \texttt{subcaption} \text{ package [38]. It provides} \\
\quad \texttt{\textbackslash panel} & \quad \text{sub-floats and takes as mandatory argument either the number of sub-floats (default 2) or the width of the first sub-float as fraction of the } \texttt{\textbackslash linwidth}. \text{ Within} \\
\]
the \begin{panels}{\begin{vertical alignment}\begin{width}\end{width}} environment the \panel macro initiates a new sub-float. In the case that the width of the first sub-float has been given as an optional argument to the \panels environment the \panel{\begin{width}} macro takes the width of the next sub-float as mandatory argument. The example code is presented in table 1a.

tabular The booktabs \cite{39} and multirow \cite{40} packages are loaded enabling publication quality tabulars such as in table 1b.

\graphic The graphicx package \cite{41} is loaded and the ~\begin{graphic}{\begin{width}\begin{figure}} macro is defined, which is a wrapper for the \includegraphics{\begin{figure}} macro and takes the figure width as fraction of the \linewidth as optional argument (default 1). If the graphics are located in a sub-folder its path can be indicated by \graphics{(subfolder)}.

\bibliography The biblatex package \cite{11} is loaded for bibliography management. The user has to add the line \bibliography{\{my.bib\}} to the preamble of the document and \printbibliography at the end of the document. The bibliography is generated by Biber \cite{42}. biblatex is extended to be able to cope with the collaboration and reportNumber fields provided by inspirehep.net and a bug in the volume number is fixed. Additionally, the PubMed IDs are recognized and ctan.org, github.com, gitlab.com, bitbucket.org, launchpad.net, sourceforge.net, and hepforge.org are valid eprinttypes. Errata can be included using the related feature.

\begin{verbatim}
\article{key1, ...
    relatedtype="erratum",
    related="key2",
}
\article{key2, ...
\end{verbatim}

2.5 Bibliography

\bibliography The biblatex package \cite{11} is loaded for bibliography management. The user has to add the line \bibliography{\{my.bib\}} to the preamble of the document and \printbibliography at the end of the document. The bibliography is generated by Biber \cite{42}. biblatex is extended to be able to cope with the collaboration and reportNumber fields provided by inspirehep.net and a bug in the volume number is fixed. Additionally, the PubMed IDs are recognized and ctan.org, github.com, gitlab.com, bitbucket.org, launchpad.net, sourceforge.net, and hepforge.org are valid eprinttypes. Errata can be included using the related feature.

3 Conclusion

The hep-paper package provides a matching selection of preloaded packages and additional macros enabling the user to focus on the content instead of the layout by reducing the amount of manual tasks. The majority of the loaded packages are fairly lightweight, the others can be deactivated with package options.

\arxiv-collector arxiv.org \cite{43} requires the setup dependent bbl files instead of the original bib files, which causes trouble if the local \LaTeX version differs from the one used by arXiv. The \arxiv-collector python script \cite{44} alleviates this problem by collecting all files necessary for publication on arXiv (including figures).
References

[29] \LaTeX{} Team. ‘The amsmath package: AMS mathematical facilities for \LaTeX{}’ (1994). CTAN: amsmath. URL: ams\-o\-rg\-tex/amslatex.
[31] \LaTeX{} Team. ‘\LaTeX{} 2\epsilon font selection: Documen\-tation of \LaTeX{} font commands’ (1995). CTAN: fntguide.
[40] P. van Oostrum and J. Leichter. ‘The \texttt{multirow}, \texttt{bigstrut} and \texttt{bigdelim} packages: Create tabular cells spanning multiple rows’ (1994). CTAN: \texttt{multirow}.


[44] D. Sutherland. ‘\texttt{arxiv-collector}: A little Python script to collect \LaTeX{} sources for upload to the arXiv’ (2018). GitHub: \texttt{dougalsutherland/arxiv-collector}.