The `hepunits` LaTeX package

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The `hepunits` v2 package extends the existing (and excellent) `siunitx` package to support units commonly used in high-energy physics. HEP uses a rather specialised set of units to describe measurements of energies, masses, momenta, reaction cross-sections, luminosities and so-on. Using this package provides particle physicists with a consistent and accurate way to refer to dimensionful HEP quantities. It additionally tweaks the often problematic character spacing around the eVand eV/c^2units, as an "eV kern" is not typically defined in LaTeX fonts.

1 Recommended usage

The basic usage mode for `hepunits` is to place `\usepackage{hepunits}` in the preamble of your document.

This loads the `amsmath` (for `\mspace`/`\mkern`) and `siunitx` packages, as well as defining new HEP units using the `siunitx` mechanisms. For convenience, it also sets the `siunitx` defaults to detect the surrounding text style (include displayed mathematics) and to use text-mode rendering of units, again to match the surrounding text font for numbers and unit text. If these features aren't wanted, or you want to set any of the myriad other `siunitx` rendering options, call the `\sisetup` macro *after* the `\usepackage{hepunits}` call.

2 Options

`hepunits` accepts three optional arguments during import:

sicmds: Also define convenience short versions of SI units, e.g. `\cm`;

noprefixcmds: Don't define convenience SI-prefixed versions of HEP units, e.g. `\GeV` in addition to `\eV`;

freestanding: Make the unit macros also usable outside the `\SI` and `\si` macros (equivalent to `\sisetup{free-standing-units=true}`.

These can be used as follows: `\usepackage[sicmds,freestanding]{heputils}`.

3 Requirements

`hepunits` requires the `siunitx` and `amsmath` packages to be installed as part of your TEX distribution. I don't know of any distributions for which this isn't the case, so chances are you're safe to just install `hepunits` and use it right away.

4 Provided units

The HEP units provided by `hepunits` are listed in Tables 1 and 2 below. All the example outputs have been produced with a command like `\SI{1.0}{`$\langle$*unit*$\rangle$`}` where $\langle$*unit*$\rangle$ is one of the unit commands listed in the first columns of the tables. Note that standard `siunitx` parsing extensions like `\SI{1.23e-4}{\GeV}` $\rightarrow 1.23 \times 10^{-4}$ GeV, and significant-digit control, also work but aren't shown here in the interests of brevity.

Note that a lot of these units have, for convenience, been provided as explicit commands with various SI prefixes, rather than just defining the base unit and using the `siunitx` prescription for the prefixes. Let's give a demo in case you don't know what I'm waffling about... the "usual" `siunitx` way of doing things is like this: `\SI{1.0}{\mega\eVc}`. This produces "1.0 MeV/c" just like `\SI{1.0}{\MeVc}` would do.

I've chosen to provide the explicit prefixed commands for convenience: choose your own favourite way (the same applies even more so for most of the non-HEP units). If you are bothered about the explictly prefixed commands clogging up the LATEX macro namespace then pass the `noprefixcmds` option to `hepunits` and the offending commands won't be defined at all. This will make life awkward when it comes to inverse cross-sections as used for integrated luminosities, but with suitable use of `\invbarn` I'm sure you can make do.

Unit command	Normal	Italic	Bold	Math
Lengths				
`\nm`	1.0 nm	*1.0 nm*	**1.0 nm**	$x = 1.0\,\mathrm{nm}$
`\um`	1.0 µm	*1.0 µm*	**1.0 µm**	$x = 1.0\,\mu\mathrm{m}$
`\mm`	1.0 mm	*1.0 mm*	**1.0 mm**	$x = 1.0\,\mathrm{mm}$
`\cm`	1.0 cm	*1.0 cm*	**1.0 cm**	$x = 1.0\,\mathrm{cm}$
`\micron`	1.0 µm	*1.0 µm*	**1.0 µm**	$x = 1.0\,\mu\mathrm{m}$
Times				
`\ns`	1.0 ns	*1.0 ns*	**1.0 ns**	$x = 1.0\,\mathrm{ns}$
`\ps`	1.0 ps	*1.0 ps*	**1.0 ps**	$x = 1.0\,\mathrm{ps}$
`\fs`	1.0 fs	*1.0 fs*	**1.0 fs**	$x = 1.0\,\mathrm{fs}$
`\as`	1.0 as	*1.0 as*	**1.0 as**	$x = 1.0\,\mathrm{as}$
Rates				
`\mHz`	1.0 mHz	*1.0 mHz*	**1.0 mHz**	$x = 1.0\,\mathrm{mHz}$
`\Hz`	1.0 Hz	*1.0 Hz*	**1.0 Hz**	$x = 1.0\,\mathrm{Hz}$
`\kHz`	1.0 kHz	*1.0 kHz*	**1.0 kHz**	$x = 1.0\,\mathrm{kHz}$
`\MHz`	1.0 MHz	*1.0 MHz*	**1.0 MHz**	$x = 1.0\,\mathrm{MHz}$
`\GHz`	1.0 GHz	*1.0 GHz*	**1.0 GHz**	$x = 1.0\,\mathrm{GHz}$
`\THz`	1.0 THz	*1.0 THz*	**1.0 THz**	$x = 1.0\,\mathrm{THz}$
Misc.				
`\mrad`	1.0 mrad	*1.0 mrad*	**1.0 mrad**	$x = 1.0\,\mathrm{mrad}$
`\gauss`	1.0 G	*1.0 G*	**1.0 G**	$x = 1.0\,\mathrm{G}$

Table 1: List of non-HEP specific units provided by `hepunits`. Other than `\gauss`, these units are only available via the `sicmds` package option.

5 Summary

`hepunits` is a handy package for particle physicists who'd like their units to look right, with upright µs, properly italicised *c*s, and properly kerned eVs in the appropriate places. Fortunately most of the work has already been done by the marvellous `siunitx` package and I've just provided a few more commands and an option passing wrapper on to that excellent piece of work.

If you have any comments, criticism, huge cash donations etc., then please do send them my way.

Unit command	Normal	Italic	Bold	Math
Luminosities				
`\invcmsq`	$1.0\,\mathrm{cm}^{-2}$	$1.0\,cm^{-2}$	$\mathbf{1.0\,cm^{-2}}$	$x = 1.0\,\mathrm{cm}^{-2}$
`\invcmsqpersecond`	$1.0\,\mathrm{cm}^{-2}\,\mathrm{s}^{-1}$	$1.0\,cm^{-2}\,s^{-1}$	$\mathbf{1.0\,cm^{-2}\,s^{-1}}$	$x = 1.0\,\mathrm{cm}^{-2}\,\mathrm{s}^{-1}$
`\invcmsqpersec`	$1.0\,\mathrm{cm}^{-2}\,\mathrm{s}^{-1}$	$1.0\,cm^{-2}\,s^{-1}$	$\mathbf{1.0\,cm^{-2}\,s^{-1}}$	$x = 1.0\,\mathrm{cm}^{-2}\,\mathrm{s}^{-1}$
Cross-sections				
`\barn`	$1.23 \times 10^{-4}\,\mathrm{b}$	$1.0\,b$	$\mathbf{1.0\,b}$	$x = 1.0\,\mathrm{b}$
`\invbarn`	$1.0\,\mathrm{b}^{-1}$	$1.0\,b^{-1}$	$\mathbf{1.0\,b^{-1}}$	$x = 1.0\,\mathrm{b}^{-1}$
`\nanobarn`	$1.0\,\mathrm{nb}$	$1.0\,nb$	$\mathbf{1.0\,nb}$	$x = 1.0\,\mathrm{nb}$
`\invnanobarn` / `\invnb`	$1.0\,\mathrm{nb}^{-1}$	$1.0\,nb^{-1}$	$\mathbf{1.0\,nb^{-1}}$	$x = 1.0\,\mathrm{nb}^{-1}$
`\picobarn`	$1.0\,\mathrm{pb}$	$1.0\,pb$	$\mathbf{1.0\,pb}$	$x = 1.0\,\mathrm{pb}$
`\invpicobarn` / `\invpb`	$1.0\,\mathrm{pb}^{-1}$	$1.0\,pb^{-1}$	$\mathbf{1.0\,pb^{-1}}$	$x = 1.0\,\mathrm{pb}^{-1}$
`\femtobarn`	$1.0\,\mathrm{fb}$	$1.0\,fb$	$\mathbf{1.0\,fb}$	$x = 1.0\,\mathrm{fb}$
`\invfemtobarn` / `\invfb`	$1.0\,\mathrm{fb}^{-1}$	$1.0\,fb^{-1}$	$\mathbf{1.0\,fb^{-1}}$	$x = 1.0\,\mathrm{fb}^{-1}$
`\attobarn`	$1.0\,\mathrm{ab}$	$1.0\,ab$	$\mathbf{1.0\,ab}$	$x = 1.0\,\mathrm{ab}$
`\invattobarn` / `\invab`	$1.0\,\mathrm{ab}^{-1}$	$1.0\,ab^{-1}$	$\mathbf{1.0\,ab^{-1}}$	$x = 1.0\,\mathrm{ab}^{-1}$

Table 2: List of HEP-specific luminosity units provided by `hepunits`.

Unit command	Normal	Italic	Bold	Math
eV-based units				
`\eV`	$1.0\,\mathrm{eV}$	$1.0\,eV$	$\mathbf{1.0\,eV}$	$x = 1.0\,\mathrm{eV}$
`\eVc`	$1.0\,\mathrm{eV}/c$	$1.0\,eV/c$	$\mathbf{1.0\,eV/c}$	$x = 1.0\,\mathrm{eV}/c$
`\eVcsq`	$1.0\,\mathrm{eV}/c^2$	$1.0\,eV/c^2$	$\mathbf{1.0\,eV/c^2}$	$x = 1.0\,\mathrm{eV}/c^2$
`\meV`	$1.0\,\mathrm{meV}$	$1.0\,meV$	$\mathbf{1.0\,meV}$	$x = 1.0\,\mathrm{meV}$
`\keV`	$1.0\,\mathrm{keV}$	$1.0\,keV$	$\mathbf{1.0\,keV}$	$x = 1.0\,\mathrm{keV}$
`\MeV`	$1.0\,\mathrm{MeV}$	$1.0\,MeV$	$\mathbf{1.0\,MeV}$	$x = 1.0\,\mathrm{MeV}$
`\GeV`	$1.0\,\mathrm{GeV}$	$1.0\,GeV$	$\mathbf{1.0\,GeV}$	$x = 1.0\,\mathrm{GeV}$
`\TeV`	$1.0\,\mathrm{TeV}$	$1.0\,TeV$	$\mathbf{1.0\,TeV}$	$x = 1.0\,\mathrm{TeV}$
`\meVc`	$1.0\,\mathrm{meV}/c$	$1.0\,meV/c$	$\mathbf{1.0\,meV/c}$	$x = 1.0\,\mathrm{meV}/c$
`\keVc`	$1.0\,\mathrm{keV}/c$	$1.0\,keV/c$	$\mathbf{1.0\,keV/c}$	$x = 1.0\,\mathrm{keV}/c$
`\MeVc`	$1.0\,\mathrm{MeV}/c$	$1.0\,MeV/c$	$\mathbf{1.0\,MeV/c}$	$x = 1.0\,\mathrm{MeV}/c$
`\GeVc`	$1.0\,\mathrm{GeV}/c$	$1.0\,GeV/c$	$\mathbf{1.0\,GeV/c}$	$x = 1.0\,\mathrm{GeV}/c$
`\TeVc`	$1.0\,\mathrm{TeV}/c$	$1.0\,TeV/c$	$\mathbf{1.0\,TeV/c}$	$x = 1.0\,\mathrm{TeV}/c$
`\meVcsq`	$1.0\,\mathrm{meV}/c^2$	$1.0\,meV/c^2$	$\mathbf{1.0\,meV/c^2}$	$x = 1.0\,\mathrm{meV}/c^2$
`\keVcsq`	$1.0\,\mathrm{keV}/c^2$	$1.0\,keV/c^2$	$\mathbf{1.0\,keV/c^2}$	$x = 1.0\,\mathrm{keV}/c^2$
`\MeVcsq`	$1.0\,\mathrm{MeV}/c^2$	$1.0\,MeV/c^2$	$\mathbf{1.0\,MeV/c^2}$	$x = 1.0\,\mathrm{MeV}/c^2$
`\GeVcsq`	$1.0\,\mathrm{GeV}/c^2$	$1.0\,GeV/c^2$	$\mathbf{1.0\,GeV/c^2}$	$x = 1.0\,\mathrm{GeV}/c^2$
`\TeVcsq`	$1.0\,\mathrm{TeV}/c^2$	$1.0\,TeV/c^2$	$\mathbf{1.0\,TeV/c^2}$	$x = 1.0\,\mathrm{TeV}/c^2$

Table 2: List of HEP-specific units provided by `hepunits` (cont.)