The `hepparticles` package for LaTeX

Describing `hepparticles` version 2.0

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Abstract

This package provides macros for typesetting high energy physics particle names in a consistent, semantic and aesthetically pleasing manner, as well as fixing problems with math-mode boldness problems in section titles. You may also be interested in the `heppennames` and `hepnicenames` packages, which use this one to provide a large set of pre-existing particle names.

This document describes version 2.0, which significantly improves the output quality over versions 1.x, removes several macros & package options, and changes dependencies.

1 Motivation

Typesetting the names of high-energy fundamental particles (and their elementary composites) is well-defined by a set of rules:

- The basic particle name consists of a large Roman or Greek symbol with optional following sub- and super-scripts.
- Depending on convention, the symbols for particles are either italic or upright. Using the latter convention, the symbols should be upright when describing a specific particle; if describing a generic class of particles they should be italicised (where possible). In italic and bold contexts the symbols should adapt by becoming bold and italic themselves where possible.
- Anti-particles are written with a bar on top of the main symbol (but for aesthetic reasons the bar does not extend above the sub- and super-scripts.

- Supersymmetric partners of Standard Model particles are written as for anti-particles but with a tilde in place of the bar. SUSY anti-particles (though the use of symbols to represent them is currently uncommon) may be written with a bar above the tilde.
- Resonant states may sport an extra resonance specifier consisting of a value in parentheses and optional following sub- and super-scripts. This follows the main particle name.

Several issues arise when typesetting these particle names in standard LaTeX: for starters the requirement of sub- and super-scripts and the need to use Greek symbols forces us into math mode. But math mode does not usually follow the surrounding text context for boldness and italicism: this has been fixed in this specific case by use of the `maybemath` package. Secondly, the positions of super-scripts with overlines and tildes are affected: this is also corrected by this package. By request, the particle typesetting conventions may be specified as a package option. All the `hepparticles` commands may be used either in or out of math mode.

2 Commands

- For generic particle names e.g. all positively charged leptons:
  \HepGenParticle{*main*}{*subscript*}{*superscript*}
  \HepGenAntiParticle{*main*}{*subscript*}{*superscript*}
- For concrete particle names:
  \HepParticle{*main*}{*subscript*}{*superscript*}
  \HepAntiParticle{*main*}{*subscript*}{*superscript*}
- For supersymmetric "sparticles":
  \HepGenSusyParticle{*main*}{*subscript*}{*superscript*}
  \HepSusyParticle{*main*}{*subscript*}{*superscript*}
  \HepGenSusyAntiParticle{*main*}{*subscript*}{*superscript*}
  \HepSusyAntiParticle{*main*}{*subscript*}{*superscript*}
- For resonance specifiers (just the extra terms):
  \HepResonanceMassTerm{*mainterm*}{*subscript*}{*superscript*}
  \HepResonanceSpecTerm{*mainterm*}{*subscript*}{*superscript*}

- For a full particle name and resonance specification:
  \HepParticleResonance{*name*}{*mass*}{*massSub*}{*massSup*}
  \HepParticleResonanceFull{*main*}{*sub*}{*sup*}{*mass*}{*massSub*}{*massSup*}
  \HepParticleResonanceFormal{*name*}\
  {*mass*}{*massSub*}{*massSup*}{*spec*}{*specSub*}{*specSup*}
  \HepParticleResonanceFormalFull{*main*}{*sub*}{*sup*}\
  {*mass*}{*massSub*}{*massSup*}{*spec*}{*specSub*}{*specSup*}
  (hurrah, we hit the TEX 9-argument limit!)
- And finally, for containing processes describing particle evolution:
  \HepProcess{*iParticles* \to *fParticles*}.

These commands respectively typeset particle names like this:

- Normal particles: B^0_d, $\overline{\mathrm{B}}^0_\mathrm{d}$
- Generic particles: q_d, $\bar{\ell}_\mu$
- SUSY particles: $\widetilde{\chi}_1$, $\widetilde{q}_2$
- Resonances: $J/\psi(1\mathrm{S})^\star$
- Process: $\mathrm{B}^0_\mathrm{d} \to \mathrm{K}^-\pi^+$.

3 Package options

By request, the package can typeset particles in italic as well as upright convention. The choice of convention can be made when the package is loaded with the `italic` option, i.e. `\usepackage[italic]{hepparticles}`. The default mode is upright.

The `forceit`, `maybess` and `noss` options have been removed in version 2.0.

4 Installation

Requirements: You will need to be using a LATEX 2_ε system to use `hepparticles`. Hopefully this isn't a problem — I wasn't feeling up to writing a Plain TEX version! `hepparticles` 2.0 requires the `subdepth` package.

To install, simply copy the `hepparticles.sty` file into a location in your `LATEXINPUTS` path. Tada!

5 Credit where it's due...

Thanks to Viet-Trung Luu for providing the initial "way forward" when writing this package: his solution, in expanded form, made its way into what is now the `maybemath` package. Thanks also to Heiko Oberdiek and Donald Arseneau for showing how to stop the `\mspace`s from turning up in PDF bookmarks generated by `hyperref`. Philip Ratcliffe provided the hack that moves over-lines slightly to the right for use with italic particle symbols. In version 2.0 I owe a great deal to the subdepth package

Any feedback is appreciated! Email to `andy@insectnation.org`, please.