

# The letterswitharrows package

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This package provides math-mode commands for setting left and right arrows over mathematical symbols, so that the arrows dynamically scale with the symbols. Here is a sample:

$$\vec{s} \leq \vec{t} \in \vec{U}_r \quad |\overrightarrow{AB}| = |\overleftarrow{AB}| \quad A \overleftrightarrow{\text{X}} B$$

While it is possible to set arrows over longer strings of symbols, the focus lies on single characters.

Only PDF output is supported. Output to PS is implemented, but rarely tested. For a wider range of formats there is pgf-based output.

## 1 Usage

The package provides the general-purpose `\arrowoverset` command, as well as some sets of predefined shorthand commands.

### 1.1 Presets

The presets are selected by passing them as options to the `presets` package option. For instance, to define the `abc` and the `vec-cev` sets of commands you would load the package like so:

```
\usepackage[presets={abc,vec-cev}]{letterswitharrows}
```

By default, the `abc`, `ABC` and `cAcBcC` presets are loaded.

`abc` Passing `abc` to the `presets` option allows you to use the `\v<char>` and `\<char>v` commands for all the lower-case letters `a` through `z` except for `v`.

---

`\v<char>`  
`\<char>v`  
`\vleft`  
`\vright`

---

For the letter `v` the commands `\vleft` and `\vright` are provided.

$$\vec{a}, \vec{b}, \vec{c}, \vec{d}, \vec{m}, F_{\vec{t}}$$

```
\[ \va, \vb, \vc, \dv, \mv, F_{\tv} \]
```

`ABC` Passing `ABC` to the `presets` option allows you to use the `\v<CHAR>` and `\<CHAR>v` commands for all the upper-case letters `A` through `Z`.

---

`\v<CHAR>`  
`\<CHAR>v`

---

$\vec{A}, \vec{B}, \vec{C}, \vec{D}, \vec{E}, F_{\vec{G}}$

`\[ \vA, \vB, \vC, \vDv, \Ev, F_\vG \]`

`cAcBcC`

Passing `cAcBcC` to the `presets` option allows you to use the `\vc<CHAR>` and `\c<CHAR>v` commands for all the upper-case letters A through Z to set arrows over `\mathcal`-letters.

---

`\vc<CHAR>`  
`\c<CHAR>v`

---

$\vec{A}, \vec{B}, \vec{C}, \vec{D}, \vec{E}, F_{\vec{G}}$

`\[ \vcA, \vcB, \vcC, \cDv, \cEv, F_\cGv \]`

`vec-cev`

Passing `vec-cev` to the `presets` option (re)defines the `\vec` and `\cev` commands.

---

`\vec`  
`\cev`

---

Unlike the other commands these do not automatically consume subsequent subscripts or ' tokens.

$\vec{x} := \overrightarrow{AB} \quad \langle \vec{w}, \vec{v} \rangle = 42$

`\[ \vec{\mathbf{x}} := \cev{AB} \quad \langle \vw, \vright \rangle = 42 \]`

## 1.2 The `\arrowoverset` command

---

`\arrowoverset`  
`\arrowoverset*`

---

`\arrowoverset` [*xoffset*] [*xscale*] [*yoffset*] {*math*}  
`\arrowoverset*` [*xoffset*] [*xscale*] [*yoffset*] {*math*}

This command sets a right (or left if `\arrowoverset*` is used) arrow over *math*. The base length of the arrow is the width of the *math* multiplied by *xscale*, which must be specified as a fraction *num*/*denom*. The arrow is offset by *xoffset* to the right, which must be a math skip expression, and by *yoffset* to the top, which must be a skip expression.

This command consumes subsequent subscripts or up to two primes '. The former does not affect the length of the arrow.

## 1.3 Other package options

`pgf` If you specify the `pgf` option, every arrow is drawn as a `pgfpicture`. This requires the `pgf` package.

**T<sub>E</sub>Xhackers note:** You can set up custom arrow drawing code by redefining `\_jmt\_lwa\_arrow\_draw:nnn`. The command is expected to draw an arrow with its head at the current position. Its length should be #1 and it should be drawn at a font size of #2pt. If #3 is - if the arrow should point rightwards and empty otherwise.

`linewidth`

Specifying `linewidth=<value>` as a package option allows you to adjust the line width of the arrows to adjust for the weight of the maths font you are using. The default value is `linewidth=0.3`.

`tweaks`

Specifying the `tweaks` option applies per-letter scaling adjustments to some of the

single-letter shorthands. This is enabled by default. These are specific to Latin Modern Math and subject to be changed on a whim. If you wish a more stable behaviour specify `tweaks=false`. This documentation uses `tweaks=false`.

## 2 Implementation

```

1 \NeedsTeXFormat{LaTeX2e}
2 \RequirePackage{expl3}
3 \ProvidesExplPackage {letterswitharrows} {2021/07/19} {} {Draw arrows over math letters.}
4 \RequirePackage{xparse,l3keys2e,mathtools}
5 % TODO: I just use mathtools for mathrlap; replace.
6
7 <@@=jmt_lwa>
8 \msg_new:nnn {letterswitharrows} {pdf-only} {Only-pdf-output~is~supported.}
9 \AtBeginDocument{
10   \sys_if_output_pdf:F {
11     \msg_warning:nn {letterswitharrows} {pdf-only}
12   }
13 }

```

The drawing code.

```

\__jmt_lwa_arrow_draw_special:nnn
\__jmt_lwa_arrow_draw_pgf:nnn
\__jmt_lwa_arrow_left:nn
\__jmt_lwa_arrow_right:nn
14 \cs_new:Nn \__jmt_lwa_arrow_draw_special:nnn % length, font size, sign
15 {
16   \sys_if_output_pdf:TF {
17     \tex_special:D {pdf:~
18       q~
19       1~J~1~j~
20       1~0~0~\dim_to_decimal:n{#3#2pt/10}~0~0~cm~
21       \fp_use:c{g__jmt_lwa_line_width}~w~
22       q~
23       \dim_to_decimal:n{#3#2pt/10}~0~0~1~0~0~cm~
24       1~0~0~1~1~0~cm~
25       0~1~m~
26       .25~0~1~0~1~0~c~
27       1~0~.25~0~0~1~c~
28       S~
29       Q~
30       Q~
31       q~
32       0~0~m~
33       -1~0~0~1~0~0~cm~
34       \fp_use:c{g__jmt_lwa_line_width}~w~
35       \dim_to_decimal:n{#3#1}~0~1~S~
36       Q
37     }
38   } {
39     \tex_special:D {"~
40       1~setlinecap~1~setlinejoin~
41       1~0~0~\dim_to_decimal:n{#3#2pt/10}~0~0~6~array~astore~concat~
42       \fp_use:c{g__jmt_lwa_line_width}~setlinewidth~
43       gsave~
44       \dim_to_decimal:n{#3#2pt/10}~0~0~1~0~0~6~array~astore~concat~

```

```

45     1~0~0~1~-1~0~6~array~astore~concat~
46     0~1~moveto~
47     .25~0~1~0~1~0~curveto~
48     1~0~.25~0~0~-1~curveto~
49     stroke~
50     grestore~
51     0~0~moveto~
52     -1~0~0~1~0~0~6~array~astore~concat~
53     \dim_to_decimal:n{#3#1}~0~lineto~stroke
54   }
55 }
56 }
57
58 % TODO
59 % \tl_new:N \g__jmt_lwa_pgf_arrow_style_tl
60 % \tl_set:Nn \g__jmt_lwa_pgf_arrow_style_tl
61 % {Computer~Modern~Rightarrow[width=#2pt*2/10,length=#2pt/10,sharp]}
62
63 \cs_new:Nn \__jmt_lwa_arrow_draw_pgf:nnn {
64   \begin{pgfpicture}
65     \pgfsetlinewidth{#2pt*\fp_use:c{g__jmt_lwa_line_width}/10}
66     \pgfsetarrowsstart
67     {Computer~Modern~Rightarrow[width=#2pt*2/10,length=#2pt/10,sharp]}
68     % \pgfsetarrowsstart{\tl_use:N \g__jmt_lwa_pgf_arrow_style_tl}
69     \pgfpathmoveto{\pgfpointorigin}
70     \pgfpathlineto{\pgfpoint{-#3#1}{0cm}}
71     \pgfusepath{stroke}
72     \pgfresetboundingbox
73   \end{pgfpicture}
74 }
75
76 \cs_new_eq:NN \__jmt_lwa_arrow_draw:nnn \use_none:nnn
77
78 \cs_new:Nn \__jmt_lwa_arrow_right:nn {
79   \skip_horizontal:n {#1}
80   % \rule[\dimexpr -#2pt/6\relax]{#1}{\dimexpr #2pt/3\relax}
81   \__jmt_lwa_arrow_draw:nnn {#1} {#2} {}
82 }
83
84 \cs_new:Nn \__jmt_lwa_arrow_left:nn {
85   \__jmt_lwa_arrow_draw:nnn {#1} {#2} {-}
86   \skip_horizontal:n {#1}
87   % \rule[\dimexpr -#2pt/6\relax]{#1}{\dimexpr #2pt/3\relax}
88 }

```

(End definition for \\_\_jmt\_lwa\_arrow\_draw\_special:nnn and others.)

The core functions.

```

\__jmt_lwa_arrow_overset_style:Nnncnnn
\__jmt_lwa_arrow_overset:nnnnn

```

```

89 \cs_new:Npn \__jmt_lwa_arrow_overset_style:Nnncnnn #1#2#3#4#5#6#7 {
90   \hbox_set:Nn \l_tmpa_box {$\m@th#1#3$}
91   \dim_set:Nn \l_tmpa_dim {#2 pt/10}
92   \vbox:n {
93     \tex_lineskiplimit:D = \maxdimen
94     \tex_baselineskip:D = 0pt

```

```

95 \tex_tabskip:D = Opt
96 \tex_lineskip:D = \dim_eval:n {\l_tmpa_dim * 3/2 + #7}
97 \tex_halign:D { ## \tex_cr:D
98   \skip_horizontal:n {\l_tmpa_dim / 2}
99   $
100   \m@th
101   #1
102   \tex_mskip:D \muskip_eval:n {#5}
103   \use:c {#4} {\dim_eval:n{\box_wd:N \l_tmpa_box * #6}} {#2}
104   $
105   \tex_cr:D
106   \box_use_drop:N \l_tmpa_box
107   \tex_cr:D
108 }
109 }
110 }
111
112 \cs_new:Nn \__jmt_lwa_arrow_overset:nnnnn { % content, direction, xoffset, scale, yoffset
113   \mathchoice {
114     \__jmt_lwa_arrow_overset_style:Nnncnnn
115     \displaystyle {\tf@size} {#1} {\__jmt_lwa_arrow_#2:nn} {#3} {#4} {#5}
116   } {
117     \__jmt_lwa_arrow_overset_style:Nnncnnn
118     \textstyle {\tf@size} {#1} {\__jmt_lwa_arrow_#2:nn} {#3} {#4} {#5}
119   } {
120     \__jmt_lwa_arrow_overset_style:Nnncnnn
121     \scriptstyle {\sf@size} {#1} {\__jmt_lwa_arrow_#2:nn} {#3} {#4} {#5}
122   } {
123     \__jmt_lwa_arrow_overset_style:Nnncnnn
124     \scriptscriptstyle {\ssf@size} {#1} {\__jmt_lwa_arrow_#2:nn} {#3} {#4} {#5}
125   }
126 }

```

(End definition for \\_\_jmt\_lwa\_arrow\_overset\_style:Nnncnnn and \\_\_jmt\_lwa\_arrow\_overset:nnnnn.)

\\_\_jmt\_lwa\_arrow\_overset:w

**\arrowoverset**

```

127 \cs_new_protected:Npn \__jmt_lwa_arrow_overset:w {
128   \c_group_begin_token
129   \__jmt_lwa_arrow_overset_aux:w
130 }
131
132 \cs_new:Nn \__jmt_lwa_bool_convert:n {
133   \IfBooleanTF {#1} {\c_true_bool} {\c_false_bool}
134 }
135
136 % This exp_args is necessary because _ generates the wrong token in expl3 syntax
137 \exp_args:NNx \NewDocumentCommand \__jmt_lwa_arrow_overset_aux:w
138   {s O{0mu} O{1} O{0ex} m t' e{\char_generate:nn {95}{8}} t'} {
139   \__jmt_lwa_arrow_overset:nnnnn
140   {
141     #5
142     \exp_args:Nf\bool_if:nT{\__jmt_lwa_bool_convert:n{#6} || \__jmt_lwa_bool_convert:n{#8}}
143     \c_math_superscript_token {
144       \scriptscriptstyle\IfBooleanT{#6}{\prime}\IfBooleanT{#8}{\prime}
145     }

```

```

146     } % TODO: Better positioning etc?
147     \exp_args:Nf\IfValueT{\use:n#7} {
148       \c_math_subscript_token {
149         \mathrlap{#7}
150       }
151     }
152   }
153   {\IfBooleanTF{#1}{left}{right}}
154   {#2} {#3} {#4}
155
156   \exp_args:Nf\IfValueTF{\use:n#7}{
157     % TODO: Better way to do this? This is all kinds of wrong.
158     \hphantom{\c_math_subscript_token{#7}}
159   } {}
160   \c_group_end_token
161 }
162 \cs_set_eq:NN \arrowoverset \__jmt_lwa_arrow_overset:w

```

Replacements for hyperref bookmarks.

```

163 \AtBeginDocument{
164   \@ifpackageloaded{hyperref}{
165     \pdfstringdefDisableCommands{
166       % Why does this only work with Expandable?
167       \DeclareExpandableDocumentCommand \__jmt_lwa_arrow_overset:w {s o o o m} {
168         \ifpdfstringunicode
169           {#5 \IfBooleanTF{#1}{\unichar{"20D6}}{\unichar{"20D7}}}
170         {#5}
171       }
172     }
173   }{}
174 }

```

(End definition for `\__jmt_lwa_arrow_overset:w` and `\arrowoverset`. This function is documented on page 2.)

Package option handling.

```

\g__jmt_lwa_tweak_shortcuts_bool
\g__jmt_lwa_selected_presets_prop
\__jmt_lwa_arrow_draw:nnn
175 \bool_new:N \g__jmt_lwa_tweak_shortcuts_bool
176 \prop_new:N \g__jmt_lwa_selected_presets_prop
177 \keys_define:nn {letterswitharrows} {
178   mode .choice:,
179   mode / special .code:n = {
180     \cs_set_eq:NN \__jmt_lwa_arrow_draw:nnn \__jmt_lwa_arrow_draw_special:nnn
181   },
182   mode / pgf .code:n = {
183     \RequirePackage{pgf}
184     \ExplSyntaxOff\usepgflibrary{arrows.meta}\ExplSyntaxOn
185     \cs_set_eq:NN \__jmt_lwa_arrow_draw:nnn \__jmt_lwa_arrow_draw_pgf:nnn
186   },
187   mode .initial:n = {special},
188   pgf .meta:n = {mode = pgf},
189   presets .multichoices:nn = {abc, ABC, cAcBcC, vec-cev} {
190     \int_compare:nNnTF \l_keys_choice_int = 1 {
191       \prop_gclear:N \g__jmt_lwa_selected_presets_prop
192     } {}

```

```

193   \prop_gput:NVn \g__jmt_lwa_selected_presets_prop \l_keys_choice_tl {}
194 },
195 presets .initial:n = {abc, ABC, cAcBcC},
196 tweaks .bool_set:N = \g__jmt_lwa_tweak_shortcuts_bool,
197 tweaks .initial:n = {true},
198 linewidth .fp_set:N = \g__jmt_lwa_line_width,
199 linewidth .initial:n = {.3},
200 }
201 \ProcessKeysPackageOptions{letterswitharrows}

```

(End definition for `\g__jmt_lwa_tweak_shortcuts_bool`, `\g__jmt_lwa_selected_presets_prop`, and `\__jmt_lwa_arrow_draw:nmn`.)

`\v<char>`  
`\<char>v`  
`\vleft`  
`\vright`

```

202 \prop_if_in:NnTF \g__jmt_lwa_selected_presets_prop {abc} {
203   \int_step_inline:nnn {1} {26} {
204     \int_compare:nNnTF {#1} = {22} {
205       \cs_new:cpx {vright} {
206         \exp_not:N\__jmt_lwa_arrow_overset:w{v}
207       }
208       \cs_new:cpx {vleft} {
209         \exp_not:N\__jmt_lwa_arrow_overset:w*{v}
210       }
211     } {
212       \cs_new:cpx {v\int_to_alph:n{#1}} {
213         \exp_not:N\__jmt_lwa_arrow_overset:w{\int_to_alph:n{#1}}
214       }
215       \cs_new:cpx {\int_to_alph:n{#1}v} {
216         \exp_not:N\__jmt_lwa_arrow_overset:w*{\int_to_alph:n{#1}}
217       }
218     }
219   }
220 } {}

```

(End definition for `\v<char>` and others. These functions are documented on page 1.)

`\v<CHAR>`  
`\<CHAR>v`

```

221 \prop_if_in:NnTF \g__jmt_lwa_selected_presets_prop {ABC} {
222   \int_step_inline:nnn {1} {26} {
223     \cs_new:cpx {v\int_to_Alph:n{#1}} {
224       \exp_not:N\__jmt_lwa_arrow_overset:w{\int_to_Alph:n{#1}}
225     }
226     \cs_new:cpx {\int_to_Alph:n{#1}v} {
227       \exp_not:N\__jmt_lwa_arrow_overset:w*{\int_to_Alph:n{#1}}
228     }
229   }
230 } {}

```

(End definition for `\v<CHAR>` and `\<CHAR>v`. These functions are documented on page 2.)

`\vc<CHAR>`  
`\c<CHAR>v`

```

231 \prop_if_in:NnTF \g__jmt_lwa_selected_presets_prop {cAcBcC} {
232   \int_step_inline:nnn {1} {26} {
233     \cs_new:cpx {vc\int_to_Alph:n{#1}} {
234       \exp_not:N\__jmt_lwa_arrow_overset:w{\exp_not:N\mathcal{\int_to_Alph:n{#1}}}

```

```

235 }
236 \cs_new:cpx {c\int_to_Alph:n{#1}v} {
237   \exp_not:N\__jmt_lwa_arrow_overset:w*{\exp_not:N\mathcal{\int_to_Alph:n{#1}}}
238 }
239 }
240 } {}

```

(End definition for `\vc<CHAR>` and `\c<CHAR>v`. These functions are documented on page 2.)

`\vec`

`\cev`

```

241 \prop_if_in:NnTF \g__jmt_lwa_selected_presets_prop {vec-cev} {
242   \RenewDocumentCommand \vec {m} {
243     \__jmt_lwa_arrow_overset:w {#1} \scan_stop:
244   }
245   \DeclareDocumentCommand \cev {m} {
246     \__jmt_lwa_arrow_overset:w* {#1} \scan_stop:
247   }
248 } {}

```

(End definition for `\vec` and `\cev`. These functions are documented on page 2.)

Some personal-preference tweaks.

```

249 \bool_if:NTF \g__jmt_lwa_tweak_shortcuts_bool {
250   \prop_if_in:NnTF \g__jmt_lwa_selected_presets_prop {ABC} {
251     \int_step_inline:nnn {1} {26} {
252       \cs_set:cpx {v\int_to_Alph:n{#1}} {
253         \exp_not:N\__jmt_lwa_arrow_overset:w[2.5mu][8/10]{\int_to_Alph:n{#1}}
254       }
255       \cs_set:cpx {\int_to_Alph:n{#1}v} {
256         \exp_not:N\__jmt_lwa_arrow_overset:w*[2.5mu][7/10]{\int_to_Alph:n{#1}}
257       }
258     }
259     \cs_set:cpn {vS} {
260       \__jmt_lwa_arrow_overset:w[3mu][7/10]{S}
261     }
262     \cs_set:cpn {vT} {
263       \__jmt_lwa_arrow_overset:w[2mu][8/10]{T}
264     }
265     \cs_set:cpn {Tv} {
266       \__jmt_lwa_arrow_overset:w*[1mu][8/10]{T}
267     }
268     \cs_set:cpn {vU} {
269       \__jmt_lwa_arrow_overset:w[2mu][7/10]{U}
270     }
271     \cs_set:cpn {Uv} {
272       \__jmt_lwa_arrow_overset:w*[2mu][7/10]{U}
273     }
274     \cs_set:cpn {vV} {
275       \__jmt_lwa_arrow_overset:w[2.5mu][7/10]{V}
276     }
277     \cs_set:cpn {Vv} {
278       \__jmt_lwa_arrow_overset:w*[2mu][7/10]{V}
279     }
280     \cs_set:cpn {vX} {
281       \__jmt_lwa_arrow_overset:w[3mu][7/10]{X}

```



```

282     }
283     \cs_set:cpn {vY} {
284         \__jmt_lwa_arrow_overset:w[2mu] [8/10]{Y}
285     }
286     \cs_set:cpn {Yv} {
287         \__jmt_lwa_arrow_overset:w*[2mu] [7/10]{Y}
288     }
289 } {}
290 \prop_if_in:NnTF \g__jmt_lwa_selected_presets_prop {cAcBcC} {
291     \int_step_inline:nnn {1} {26} {
292         \cs_set:cpx {vc\int_to_Alph:n{#1}} {
293             \exp_not:N\__jmt_lwa_arrow_overset:w[1mu] [9/10]{\exp_not:N\mathcal{\int_to_Alph:n{#1}}}
294         }
295         \cs_set:cpx {c\int_to_Alph:n{#1}v} {
296             \exp_not:N\__jmt_lwa_arrow_overset:w*[1.5mu] [8/10]{\exp_not:N\mathcal{\int_to_Alph:n{#1}}}
297         }
298     }
299 } {}
300 \prop_if_in:NnTF \g__jmt_lwa_selected_presets_prop {abc} {
301     \cs_new:cpn {vell} {
302         \__jmt_lwa_arrow_overset:w{\ell}
303     }
304     \cs_new:cpn {ellv} {
305         \__jmt_lwa_arrow_overset:w{\ell}
306     }
307 } {}
308 } {}

```

## Change History

2019/02/04	General: Tweaks for capital letters. . . . 8	2020/05/08	General: Reset tabskip. Fixes spacing in aligned environments . . . . . 4
	\arrowoverset: Subscript spacing adjustments . . . . . 5	2021/07/10	General: Implement adjustable linewidth. . . . . 3
2019/11/21	General: Require expl3 before \ProvidesExplPackage. . . . . 3		