# `annotate-equations.sty`, v.0.2.2

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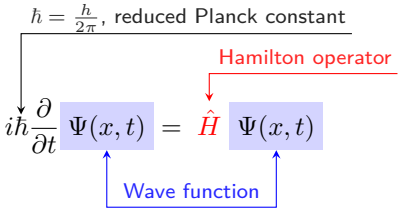
`https://github.com/st--/annotate-equations`

This package is there to make it easier to make annotated equations in LaTeX, such as in this example:




```
\vspace{4em}
\renewcommand{\eqnhighlightheight}{\vphantom{\hat{H}}\mathstrut}
\begin{equation*}
    i \tikzmarknode{hbar}{\mathstrut\hbar} \frac{\partial}{\partial t}
    \eqnmarkbox[blue]{Psi1}{\Psi(x, t)} = \eqnmark[red]{Hhat}{\hat{H}}
    \eqnmarkbox[blue]{Psi2}{\Psi(x, t)}
\end{equation*}
\annotate[yshift=3em]{above}{hbar}{$\hbar = \frac{h}{2\pi}$, reduced Planck constant}
\annotate[yshift=1em]{above}{Hhat}{Hamilton operator}
\annotatetwo[yshift=-1em]{below}{Psi1}{Psi2}{Wave function}
\vspace{1em}
```

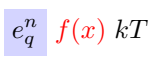
There is still a bit of manual tweaking required (such as adding vertical space before/after the equation), but hopefully this package will already make it a bit more inviting to annotate your equations!

Note that this package relies on TikZ's `remember picture` option and therefore you have to compile your LaTeX document at least twice to get everything in the right place (or just use `latexmk`!).

## Contents

# 1 Marking annotation targets within your equation

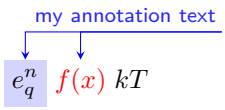
Use `\eqnmarkbox[`⟨*color*⟩`]{`⟨*node name*⟩`}{`⟨*equation term(s)*⟩`}` or `\eqnmark[`⟨*color*⟩`]{`⟨*node name*⟩`}{`⟨*equation term(s)*⟩`}` to define the target of an annotation within your equation. `\eqnmarkbox` adds background shading, whereas `\eqnmark` changes the text color. (You can also use `\tikzmarknode{`⟨*node name*⟩`}{`⟨*equation term(s)*⟩`}`, but this is likely to end up with the arrow tip too close to the target, so you may want to also pass the `outer ysep` option, see section 5.3.)



```
\begin{equation*}
    \eqnmarkbox[blue]{node1}{e_q^n}
    \eqnmark[red]{node2}{f(x)}
    \tikzmarknode{node3}{kT}
\end{equation*}
```

# 2 Simple annotations

Once you have defined nodes within your equations, you can annotate them using `\annotate[`⟨*tikz options*⟩`]{`⟨*annotate keys*⟩`}{`⟨*node name[,...]*⟩`}{`⟨*annotation text*⟩`}`. ⟨*tikz options*⟩ is passed through to the options for the TikZ node defining the annotation; its most important use is to set the `yshift`. For ⟨*annotate keys*⟩, see section 2.1. ⟨*node name*⟩ is the same name you used to mark the node within the equation, e.g. using `\eqnmarkbox`. ⟨*annotation text*⟩ is the text of the annotation itself.




```
\begin{equation*}
    \eqnmarkbox[blue]{node1}{e_q^n}
    \eqnmark[red]{node2}{f(x)}
    \tikzmarknode{node3}{kT}
\end{equation*}
\annotate[yshift=1em]{}{node1,node2}{my annotation text}
```

You generally need to manually adjust the `yshift` to move the annotations to an appropriate distance above (or negative values for below) the equation. If you want an annotation below the equation, with negative `yshift`, remember to also pass the `below` option (see section 2.1). (You can also adjust `xshift` if needed, also positive or negative.)

The annotation picks the same text color as given to `\eqnmarkbox` or `\eqnmark`, but you can also override it using `color` option.

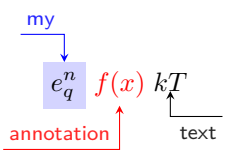
One annotation can point to multiple targets, and multiple annotations can point to the same target.

## 2.1 Annotation options

⟨*annotate keys*⟩ can be empty, or contain one or more of:

- `above` (default) or `below`,
- `right` (default) or `left`,
- `label above` (default) or `label below`.

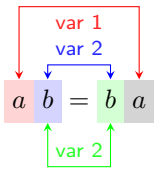
  Note: currently only works for `\annotatetwo` (section 3).




```
\begin{equation*}
    \eqnmarkbox[blue]{node1}{e_q^n}
    \eqnmark[red]{node2}{f(x)}
    \tikzmarknode{node3}{kT}
\end{equation*}
\annotate[yshift=1em]{left}{node1}{my}
\annotate[yshift=-0.5em]{below,left}{node2}{annotation}
\annotate[yshift=-1em]{below, label below}{node3}{text}
```

# 3 Double annotations

`\annotatetwo[`⟨*tikz options*⟩`]{`⟨*annotate keys*⟩`}{`⟨*first node name*⟩`}{`⟨*second node name*⟩`}{`⟨*annotation text*⟩`}`. ⟨*tikz options*⟩ and ⟨*annotate keys*⟩ are as described above in sections 2 and 2.1. Note that ⟨*annotate keys*⟩ `left/right` have no effect in `\annotatetwo`.




```
\begin{equation*}
    \eqnmarkbox[red]{a1}{a} \eqnmarkbox[blue]{b1}{b} =
    \eqnmarkbox[green]{b2}{b} \eqnmarkbox{a2}{a}
\end{equation*}
\annotatetwo[yshift=1.5em]{above, label below}{a1}{a2}{var 1}
\annotatetwo[yshift=0.5em]{above}{b1}{b2}{var 2}
\annotatetwo[yshift=-0.5em]{below}{b2}{b1}{var 2}
```

Color is picked from the first of the two nodes.

# 4 Package options

## 4.1 Size of highlight: shrink to content or always full height

`\eqnhighlightheight` is inserted into every `\eqnhighlight`, `\eqncolor`, `\eqnmark`, and `\eqnmarkbox` and by redefining it you can specify the minimum height for the corresponding box:

$\hbar\ q$

```
\renewcommand{\eqnhighlightheight}{}  % package default

\begin{equation*}
    \eqnmarkbox[red]{hbar}{\hbar} \eqnmarkbox[blue]{q}{q}
\end{equation*}
```

$\hbar\ q$

```
\renewcommand{\eqnhighlightheight}{\mathstrut}  % 0-width "constant" height

\begin{equation*}
    \eqnmarkbox[red]{hbar}{\hbar} \eqnmarkbox[blue]{q}{q}
\end{equation*}
```

`\eqnhighlightheight` is used in math mode.

Note that in some cases `\mathstrut` might not be enough, as in the introductory example:

$\hat{H}\ \Psi$

```
\renewcommand{\eqnhighlightheight}{\mathstrut}  % 0-width "constant" height

\begin{equation*}
    \eqnmarkbox[red]{Hhat}{\hat{H}} \eqnmarkbox[blue]{Psi}{\Psi}
\end{equation*}
```

You can create custom 0-width characters using `\vphantom`:

$\hat{H}\ \Psi$

```
\renewcommand{\eqnhighlightheight}{\vphantom{\hat{H}}\mathstrut}  % custom
    0-width height

\begin{equation*}
    \eqnmarkbox[red]{Hhat}{\hat{H}} \eqnmarkbox[blue]{Psi}{\Psi}
\end{equation*}
```

(It looks more balanced if you still include the `\mathstrut`.)

## 4.2 Amount of shading of mark highlight

`\eqnhighlightshade` defines the percentage of the specified color to take:

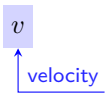
```
\renewcommand{\eqnhighlightshade}{17}  % package default

\begin{equation*}
    \eqnmarkbox[red]{hbar}{\hbar} \eqnmarkbox[blue]{q}{q}
\end{equation*}
```

By redefining this command, you can change the “alpha” value of the highlight:

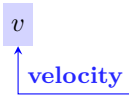
```
\renewcommand{\eqnhighlightshade}{47}  % 0 is white, 100 is solid color

\begin{equation*}
    \eqnmarkbox[red]{hbar}{\hbar} \eqnmarkbox[blue]{q}{q}
\end{equation*}
```

## 4.3 Default formatting of annotation labels

`\eqnannotationfont` sets the `font` field of the TikZ annotation label and can be re-set to change its formatting:

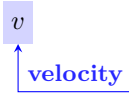



```
\renewcommand{\eqnannotationfont}{\sffamily\footnotesize}  % package
    default

\begin{equation*}
    \eqnmarkbox[blue]{v}{v}
\end{equation*}
\annotate[yshift=-0.5em]{below}{v}{velocity}
\vspace{1em}
```



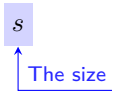

```
\renewcommand{\eqnannotationfont}{\bfseries\small}

\begin{equation*}
    \eqnmarkbox[blue]{v}{v}
\end{equation*}
\annotate[yshift=-0.5em]{below}{v}{velocity}
\vspace{1em}
```

Alternatively, you can also change the style of `annotate equations/text`:

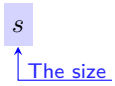



```
\tikzset{annotate equations/text/.style={font=\bfseries\small}}

\begin{equation*}
    \eqnmarkbox[blue]{v}{v}
\end{equation*}
\annotate[yshift=-0.5em]{below}{v}{velocity}
\vspace{1em}
```

`\eqnannotationstrut` is defined to be a strut (zero-width height) to provide minimum distance between the text and the corresponding arrow line. By default it is `\strut`, which has a similar effect to `\mathstrut` in `\eqnhighlightheight`.



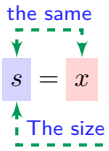

```
\renewcommand{\eqnannotationstrut}{\strut}  % package default

\begin{equation*}
        \eqnmarkbox[blue]{size}{s}
\end{equation*}
\annotate[yshift=-0.5em]{below}{size}{The size}
\vspace{1em}
```




```
\renewcommand{\eqnannotationstrut}{}

\begin{equation*}
  \eqnmarkbox[blue]{size}{s}
\end{equation*}
\annotate[yshift=-0.5em]{below}{size}{The size}
\vspace{1em}
```

### 4.4 Customize style

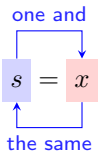
You can change the style of the annotation arrow line by setting the style of `annotate equations/arrow`:




```
\tikzset{annotate equations/arrow/.style={color=ForestGreen, >=latex',
    very thick, dashed}}

\begin{equation*}
  \eqnmarkbox[blue]{size}{s} = \eqnmarkbox[red]{other}{x}
\end{equation*}
\annotate[yshift=-0.5em]{below}{size}{The size}
\annotatetwo[yshift=1em]{above}{size}{other}{the same}
```

Note that it applies to all `\annotate` and `\annotatetwo` arrows within the scope.

You can also use this to change the arrow direction:



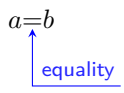

```
\begin{equation*}
  \eqnmarkbox[blue]{size}{s} = \eqnmarkbox[red]{other}{x}
\end{equation*}
\tikzset{annotate equations/arrow/.style={->}}
\annotatetwo[yshift=1em]{above}{size}{other}{one and}
\tikzset{annotate equations/arrow/.style={<-}}
\annotatetwo[yshift=-1em]{below, label below}{size}{other}{the same}  %
    note that the "direction" of the arrow is from first to second mark
```

## 5 Recommendations, tips & tricks

### 5.1 Use `\colorlet` for consistent, easily changeable colors

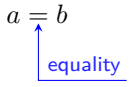
### 5.2 Relations such as "="

Wrapping a mathematical relation symbol such as = in, for example, `\tikzmarknode`, breaks how TEX determines spacing in equations:




```
\[
a \tikzmarknode{node1}{=} b
\]
\annotate[yshift=-1em]{below}{node1}{equality}
```

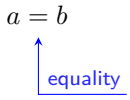
This can be fixed by wrapping the `\tikzmarknode` in `\mathrel`:




```
\[
a \mathrel{\tikzmarknode{node1}{=}} b
\]
\annotate[yshift=-1em]{below}{node1}{equality}
```

### 5.3 Extra spacing between `\tikzmarknode` and arrow

If you want more space between arrow tip and annotated term, you can pass the `outer ysep` option to `\tikzmarknode`:




```
\[
a \mathrel{\tikzmarknode[outer ysep=5pt]{node1}{=}} b
\]
\annotate[yshift=-1em]{below}{node1}{equality}
```

# 6 Known issues

- Annotations of mathematical relations require some manual patching to get the correct surrounding spacing (see section 5.2).

# 7 Backwards-incompatible changes

## v0.2.0

### `\eqnannotationtext` removed

To make it easier to format multiline annotations, version 0.2.0 introduced the `\eqnannotationfont` and `\eqnannotationstrut` (zero-argument) commands (see section 4.3).

In exchange, the `\eqnannotationtext` (one-argument) command was removed. To upgrade, replace for example

```
\renewcommand{\eqnannotationtext}[1]{\sffamily\tiny#1\strut}
```

with

```
\renewcommand{\eqnannotationfont}{\sffamily\tiny}
\renewcommand{\eqnannotationstrut}{\strut}
```