# Virginia Lake LaTeX Macros v4.2

http://alessio.guglielmi.name/res/vl

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To use this LaTeX package: `\usepackage{virginialake}`.

This package is faster and produces better results with `pdflatex`, but can also be used with `latex` + `dvips`.

If you don't need any graphical elements (most of which have curved lines), you can save some processing time and LaTeX resources by doing `\usepackage[noxy]{virginialake}`. In this case, the package does not load XY-pic.

Calling the package with `\usepackage[goodsyntax]{virginialake}` produces formulae or structures in the deep-inference style.

Calling the package with `\usepackage[lutzsyntax]{virginialake}` produces formulae or structures in the traditional style, except that it uses square brackets for disjunctions.

To compile this manual from the source make sure that `\write18` is enabled; this can be achieved by invoking `pdflatex` with the `--shell-escape` option.

**If TeX runs out of resources** while using Virginia Lake, try invoking `\usepackage{etex}` immediately after `\documentclass`.

**For use with Beamer** Inside the `frame` environment in `beamer`, parentheses and punctuation marks have a special treatment and can cause problems, notably when using square brackets for optional arguments or round brackets for atomic flow coordinates. The solution is to use the option `fragile` for every frame where Virginia Lake macros are used (as in `\begin{frame}[fragile]`). If a frame contains only one slide the option `fragile=singleslide` insures greater speed.

## 1. Symbols

The following symbols are defined:

| | | | |
|---|---|---|---|
| 1 | `\one` | c↑ | `\cU` |
| 0 | `\zer` | w↓ | `\wD` |
| f | `\fff` | w↑ | `\wU` |
| t | `\ttt` | q↓ | `\qD` |
| s | `\sw` | q↑ | `\qU` |
| m | `\me` | BV | `\BV` |
| i↓ | `\iD` | SBV | `\SBV` |
| i↑ | `\iU` | KS | `\KS` |
| c↓ | `\cD` | SKS | `\SKS` |

## 2. Formulae and Structures

Normal formulae:

$$((A \vee (B \wedge C)) \to \neg D) \leftrightarrow E) \leftarrow F \qquad \texttt{((A\vlor(B\vlan C)\vlim\vlne D)\vldi E)\vlmi F}$$

$$(A \supset (B \subset C)) \qquad \texttt{(A \vljm (B \vlmj C))}$$

$$(A \parr (B \otimes (C \triangleleft D))) \multimap E \qquad \texttt{(A \vlpa (B \vlte (C \vlse D)))\vlli E}$$

The command `\vllineartrue` triggers linear logic additive conjunction and disjunction. It is reversed by `\vllinearfalse`, which is the default:

$$((A \oplus (B \,\&\, C) \to \neg D) \leftrightarrow E) \leftarrow F$$

```
\vllineartrue
((A\vlor(B\vlan C)\vlim\vlne D)\vldi E)\vlmi F
```

Logical operators become smaller than usual if `\vlsmallopstrue` is issued. The macro `\vlbin` creates a logical operator: *e.g.*, `\vlse` is `\vlbin\triangleleft`.

Note that the new macros `\lt` and `\gt` are defined, respectively, for $<$ and $>$ (whose corresponding ASCII characters have special meaning when dealing with formulae).

## 3. Formulae and Structures Via Punctuation and Parentheses

For typesetting formulae, it is possible to use punctuation marks and parentheses instead of macros, as shown below.

The following happens if the package is called without the option `[goodsyntax]`, or if the command `\vlnogoodsyntax` is issued:

$$\begin{array}{c} A \vee \bar{B} \\ A \vee \bar{B} \vee \cdots \vee D \vee E \\ A \;\vee\; \big(\bar{B} \wedge (C \parr (D \triangleleft (E \otimes F)))\big) \vee G \\ \big(A \vee \big(\bar{B} \;\wedge\; (C \parr (D \triangleleft (E \otimes F)))\big) \vee G\big) \\ \{A \vee \big(\bar{B} \wedge (C \;\parr\; (D \;\triangleleft\; (E \;\otimes\; F)))\big) \vee G\} \\ A\{\,\} \end{array} \qquad \begin{array}{l} \texttt{\{\vls[A.-B]\}} \\ \texttt{\{\vls[A.-B.\vldots.D.E]\}} \\ \texttt{\{\vls[A..(-B.[C;<D;(E;F)>]).G]\}} \\ \texttt{\{\vlsbr[A.(-B..[C;<D;(E;F)>]).G]\}} \\ \texttt{\{\vlscn[A.(-B.[C;;<D;;(E;;F)>]).G]\}} \\ \texttt{A\vlhole} \end{array}$$

The following happens if the package is called with the option `[goodsyntax]`, or if the command `\vlgoodsyntax` is issued:

$$\begin{array}{c} [A\ \bar{B}] \\ [A\ \bar{B}\ \ldots\ D\ E] \\ [A\ \ (\bar{B}\ [C\ \langle D\ (E\ F)\rangle])\ G] \\ [A\ (\bar{B}\ \ [C\ \langle D\ (E\ F)\rangle])\ G] \\ [A\ (\bar{B}\ [C\ \ \langle D\ \ (E\ \ F)\rangle])\ G] \\ A\{\,\} \end{array} \qquad \begin{array}{l} \texttt{\{\vls[A.-B]\}} \\ \texttt{\{\vls[A.-B.\vldots.D.E]\}} \\ \texttt{\{\vls[A..(-B.[C;<D;(E;F)>]).G]\}} \\ \texttt{\{\vlsbr[A.(-B..[C;<D;(E;F)>]).G]\}} \\ \texttt{\{\vlscn[A.(-B.[C;;<D;;(E;;F)>]).G]\}} \\ \texttt{A\vlhole} \end{array}$$

The following happens if the package is called with the option `[lutzsyntax]`, or if the command `\vllutzsyntax` is issued:

$$\begin{array}{c} A \vee \bar{B} \\ A \vee \bar{B} \vee \cdots \vee D \vee E \\ A \;\vee\; \big(\bar{B} \wedge [C \parr \langle D \triangleleft (E \otimes F)\rangle]\big) \vee G \\ \big[A \vee \big(\bar{B} \;\wedge\; [C \parr \langle D \triangleleft (E \otimes F)\rangle]\big) \vee G\big] \\ \{A \vee \big(\bar{B} \wedge [C \;\parr\; \langle D \;\triangleleft\; (E \;\otimes\; F)\rangle]\big) \vee G\} \\ A\{\,\} \end{array} \qquad \begin{array}{l} \texttt{\{\vls[A.-B]\}} \\ \texttt{\{\vls[A.-B.\vldots.D.E]\}} \\ \texttt{\{\vls[A..(-B.[C;<D;(E;F)>]).G]\}} \\ \texttt{\{\vlsbr[A.(-B..[C;<D;(E;F)>]).G]\}} \\ \texttt{\{\vlscn[A.(-B.[C;;<D;;(E;;F)>]).G]\}} \\ \texttt{A\vlhole} \end{array}$$

The command `\vlsmallbrackets` corrects a possible problem with the size of brackets:

$$\frac{(a \vee b) \wedge (\bar{a} \vee \bar{b}) \qquad \texttt{\{\vls([a.b].[-a.-b])\}}}{(a \vee b) \wedge (\bar{a} \vee \bar{b}) \qquad \begin{array}{l}\texttt{\{\vlsmallbrackets}\\ \texttt{\vls([a.b].[-a.-b])\}}\end{array}}$$

This also holds for the alternative syntax style:

$$\frac{([a\ b]\ [\bar{a}\ \bar{b}]) \qquad \texttt{\{\vls([a.b].[-a.-b])\}}}{([a\ b]\ [\bar{a}\ \bar{b}]) \qquad \begin{array}{l}\texttt{\{\vlsmallbrackets}\\ \texttt{\vls([a.b].[-a.-b])\}}\end{array}}$$

The command `\vlnosmallbrackets` undoes `\vlsmallbrackets`.

The `\vls` macro works by redefining '.', '[', ']', '(' and ')'. This, of course, can cause several problems. In practice, they are rare, except when `\vls` is an argument of a macro. In this case, one needs to 'update' the macro by calling `\vlupdate`. Compare

$$[a.b] \qquad \begin{array}{l}\texttt{\textbackslash newcommand\{\textbackslash vltest\}[1]\{\#1\}}\\ \texttt{\textbackslash vltest\{\textbackslash vls[a.b]\}}\end{array}$$

with

$$a \vee b \qquad \begin{array}{l}\texttt{\textbackslash newcommand\{\textbackslash vltest\}[1]\{\#1\}}\\ \texttt{\textbackslash vlupdate\textbackslash vltest}\\ \texttt{\textbackslash vltest\{\textbackslash vls[a.b]\}}\end{array}$$

This mechanism, in principle, works with every macro.

Sometimes it is not possible to use `\vlupdate`. For example, in the following situation (requiring the `amsmath` package):

$$\begin{aligned}
\beta_k &= \bigwedge_{k\leq i\leq n} [-c_i. - d_i] && \text{for } 1 < k \leq n,\\
\gamma_i &= (\beta_{i+1}.c_i) && \text{for } 1 \leq i < n,\\
\delta_i &= (\beta_{i+1}.d_i) && \text{for } 1 \leq i < n,\\
\gamma_n &= c_n,\\
\delta_n &= d_n.
\end{aligned}$$

```
\begin{align*}
\beta_k &=\bigwedge_{k\leq i\leq n}
                    \vls[-c_i.-d_i]
                                &
                    \text{for $1<k\le n$,}\\
\gamma_i&=\vls(\beta_{i+1}.c_i)&
                    \text{for $1\le i<n$,}\\
\delta_i&=\vls(\beta_{i+1}.d_i)&
                    \text{for $1\le i<n$,}\\
\gamma_n&=c_n,                &         \\
\delta_n&=d_n.                &
\end{align*}
```

The solution is to use the macros `\vlstore`, `\vlread` and `\lt` as follows:

$$\begin{aligned}
\beta_k &= \bigwedge_{k\leq i\leq n} \bar{c}_i \vee \bar{d}_i && \text{for } 1 < k \leq n,\\
\gamma_i &= \beta_{i+1} \wedge c_i && \text{for } 1 \leq i < n,\\
\delta_i &= \beta_{i+1} \wedge d_i && \text{for } 1 \leq i < n,\\
\gamma_n &= c_n,\\
\delta_n &= d_n.
\end{aligned}$$

```
\vlstore{%
\beta_k &=\bigwedge_{k\leq i\leq n}
                    \vls[-c_i.-d_i]
                                &
                    \text{for $1\lt k\le n$,}\\
\gamma_i&=\vls(\beta_{i+1}.c_i)&
                    \text{for $1\le i\lt n$,}\\
\delta_i&=\vls(\beta_{i+1}.d_i)&
                    \text{for $1\le i\lt n$,}\\
\gamma_n&=c_n,                &         \\
\delta_n&=d_n\vldot            &
}
\begin{align*}
\vlread
\end{align*}
```

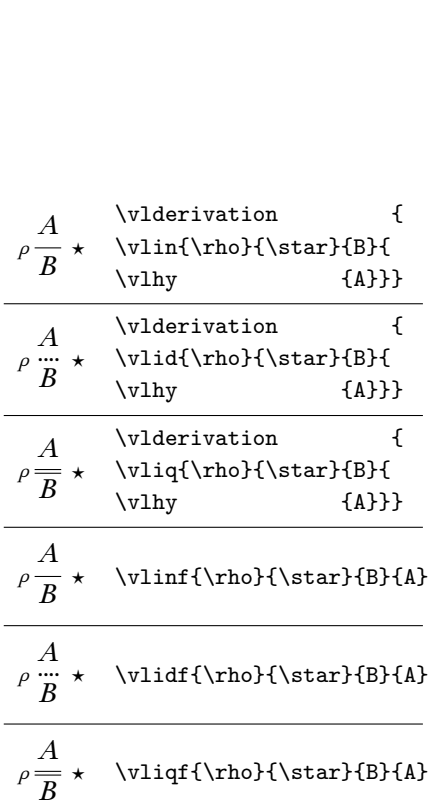
Note the use of `\vldot` in the place of `.` in the last line of the display. The commands `\vldot` for `.` and `\vlsqbrl` for `[` and `\vlsqbrr` for `]` and `\vlrobrl` for `(` and `\vlrobrr` for `)` are provided.

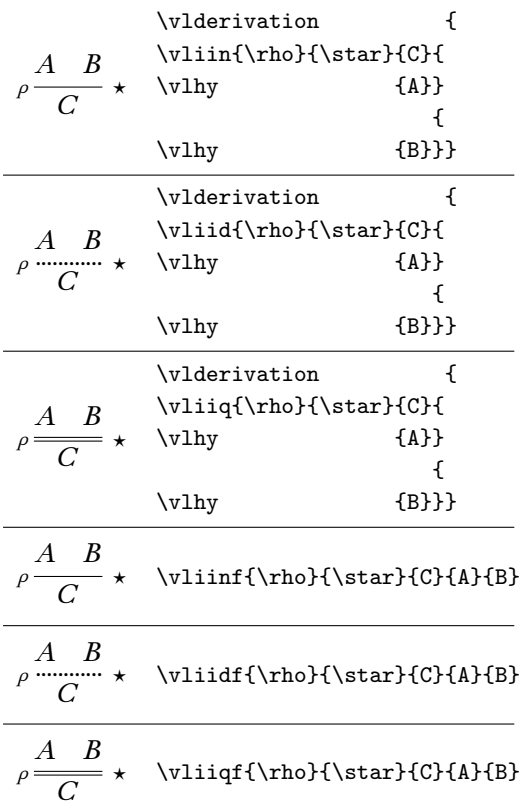
There's the command `\vlnos`, which sets '.', '[', ']', '(' and ')' to their normal behaviour, for example:

$a \wedge (.[b \wedge c].)$ `{\vls(a.{\vlnos (.[{\vls(b.c)}].)})}`

## 4. Deep Inference and Sequent Calculus Derivations

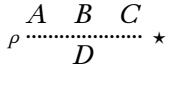
The following macros, by default, accept the commands for formulae and structures, as shown before. However, this might create problems in some circumstances, because the characters '.', ';', '[', ']', '(', ')', '<', '>' and '−', are defined in a special way. To avoid such problems, in case the commands for formulae/structures are not wanted, you can use the command `\vlnostructuressyntax`: every successive invocation of the commands for derivations does not redefine any character.


\vlderivation {
\vlin{\rho}{\star}{B}{
\vlhy {A}}}
\vlderivation {
\vlid{\rho}{\star}{B}{
\vlhy {A}}}
\vlderivation {
\vliq{\rho}{\star}{B}{
\vlhy {A}}}
\vlinf{\rho}{\star}{B}{A}
\vlidf{\rho}{\star}{B}{A}
\vliqf{\rho}{\star}{B}{A}


\vlderivation {
\vliin{\rho}{\star}{C}{
\vlhy {A}}
{
\vlhy {B}}}
\vlderivation {
\vliid{\rho}{\star}{C}{
\vlhy {A}}
{
\vlhy {B}}}
\vlderivation {
\vliiq{\rho}{\star}{C}{
\vlhy {A}}
{
\vlhy {B}}}
\vliinf{\rho}{\star}{C}{A}{B}
\vliidf{\rho}{\star}{C}{A}{B}
\vliiqf{\rho}{\star}{C}{A}{B}

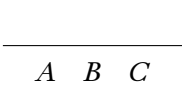
```
\vlderivation           {
\vliiin{\rho}{\star}{D}{
\vlhy                {A}}
                       {
\vlhy                {B}}
                       {
\vlhy                {C}}}
```

---



```
\vlderivation           {
\vliiid{\rho}{\star}{D}{
\vlhy                {A}}
                       {
\vlhy                {B}}
                       {
\vlhy                {C}}}
```

---



```
\vlderivation           {
\vliiiq{\rho}{\star}{D}{
\vlhy                {A}}
                       {
\vlhy                {B}}
                       {
\vlhy                {C}}}
```

---



```
\vliiinf{\rho}{\star}{D}{A}{B}{C}
```

---



```
\vliiidf{\rho}{\star}{D}{A}{B}{C}
```

---



```
\vliiiqf{\rho}{\star}{D}{A}{B}{C}
```

$$\rho\ \dfrac{A\quad B\quad C\quad D}{E}\ \star$$

```
\vlderivation            {
\vliiiin{\rho}{\star}{E}{
\vlhy                  {A}}
                         {
\vlhy                  {B}}
                         {
\vlhy                  {C}}
                         {
\vlhy                  {D}}}
```

---

$$\rho\ \dfrac{A\quad B\quad C\quad D}{E}\ \star$$

```
\vlderivation            {
\vliiiid{\rho}{\star}{E}{
\vlhy                  {A}}
                         {
\vlhy                  {B}}
                         {
\vlhy                  {C}}
                         {
\vlhy                  {D}}}
```

---

$$\rho\ \dfrac{A\quad B\quad C\quad D}{E}\ \star$$

```
\vlderivation            {
\vliiiiq{\rho}{\star}{E}{
\vlhy                  {A}}
                         {
\vlhy                  {B}}
                         {
\vlhy                  {C}}
                         {
\vlhy                  {D}}}
```

---

$$\rho\ \dfrac{A\quad B\quad C\quad D}{E}\ \star$$

```
\vliiiinf{\rho}{\star}{E}{A}{B}{C}{D}
```

---

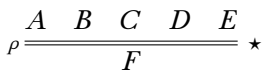
$$\rho\ \dfrac{A\quad B\quad C\quad D}{E}\ \star$$

```
\vliiiidf{\rho}{\star}{E}{A}{B}{C}{D}
```

---

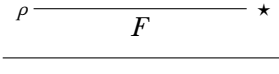
$$\rho\ \dfrac{A\quad B\quad C\quad D}{E}\ \star$$

```
\vliiiiqf{\rho}{\star}{E}{A}{B}{C}{D}
```




```
\vlderivation             {
\vliiiiin{\rho}{\star}{F}{
\vlhy                  {A}}
                          {
\vlhy                  {B}}
                          {
\vlhy                  {C}}
                          {
\vlhy                  {D}}
                          {
\vlhy                  {E}}}
```

---




```
\vlderivation             {
\vliiiiid{\rho}{\star}{F}{
\vlhy                  {A}}
                          {
\vlhy                  {B}}
                          {
\vlhy                  {C}}
                          {
\vlhy                  {D}}
                          {
\vlhy                  {E}}}
```

---




```
\vlderivation             {
\vliiiiiq{\rho}{\star}{F}{
\vlhy                  {A}}
                          {
\vlhy                  {B}}
                          {
\vlhy                  {C}}
                          {
\vlhy                  {D}}
                          {
\vlhy                  {E}}}
```

---




```
\vliiiiinf{\rho}{\star}{F}{A}{B}{C}{D}{E}
```

---

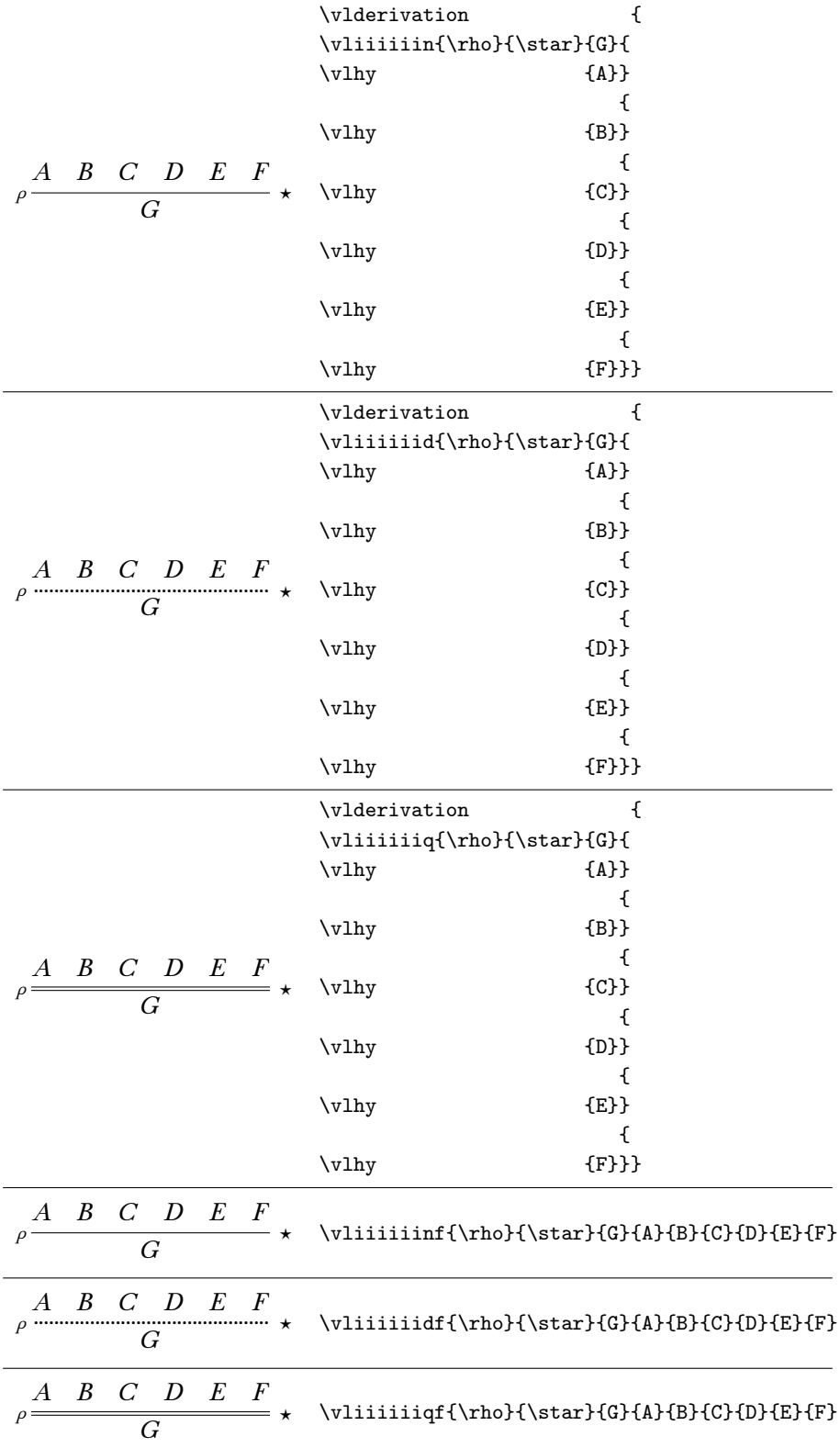



```
\vliiiiidf{\rho}{\star}{F}{A}{B}{C}{D}{E}
```

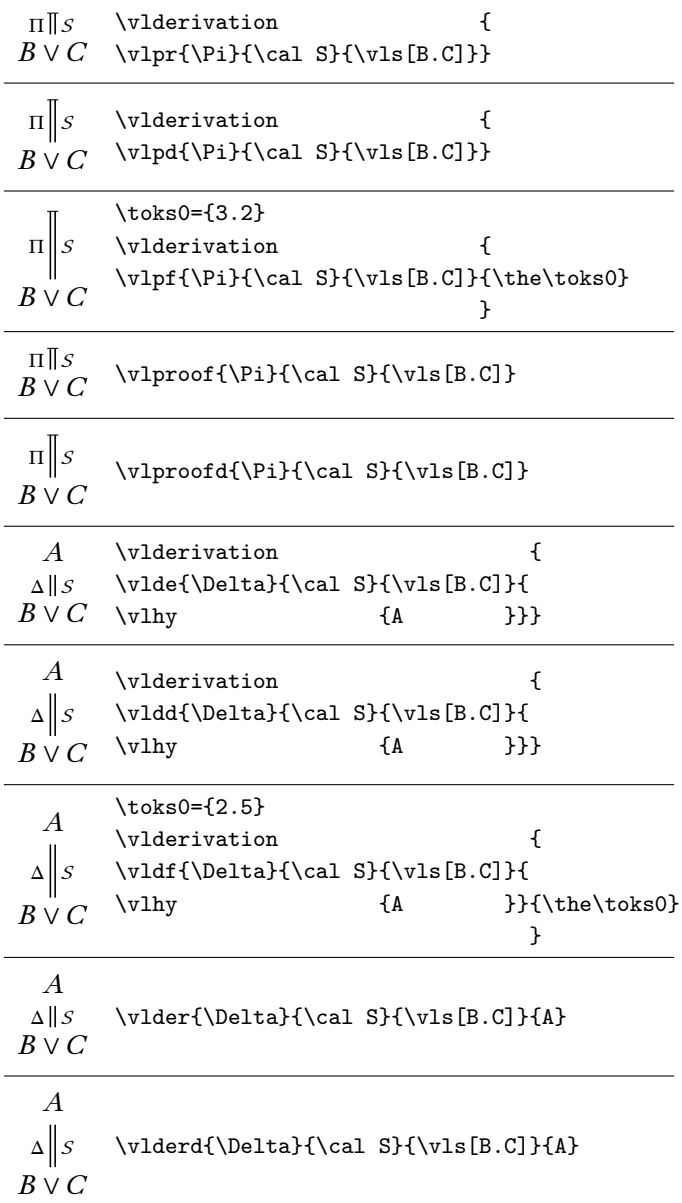
---




```
\vliiiiiqf{\rho}{\star}{F}{A}{B}{C}{D}{E}
```




The commands `\vlsmallleftlabels` and `\vlnosmallleftlabels` control the size of labels at the left of — (the $\rho$s above); the default is small size.


\vlderivation { \vlpr{\Pi}{\cal S}{\vls[B.C]}}
\vlderivation { \vlpd{\Pi}{\cal S}{\vls[B.C]}}
\toks0={3.2} \vlderivation { \vlpf{\Pi}{\cal S}{\vls[B.C]}{\the\toks0} }
\vlproof{\Pi}{\cal S}{\vls[B.C]}
\vlproofd{\Pi}{\cal S}{\vls[B.C]}
\vlderivation { \vlde{\Delta}{\cal S}{\vls[B.C]}{ \vlhy {A }}}
\vlderivation { \vldd{\Delta}{\cal S}{\vls[B.C]}{ \vlhy {A }}}
\toks0={2.5} \vlderivation { \vldf{\Delta}{\cal S}{\vls[B.C]}{ \vlhy {A }}{\the\toks0} }
\vlder{\Delta}{\cal S}{\vls[B.C]}{A}
\vlderd{\Delta}{\cal S}{\vls[B.C]}{A}

$$\rho\,\dfrac{\begin{array}{c}\Pi \,\|\, S\\ A\end{array}}{B \vee C}\ \text{note}$$

```
\vlderivation                    {
\vlin{\rho}{\rm note}{\vls[B.C]}{
\vlpr{\Pi }{\cal S  }{A        }}}
```

---

$$\dfrac{\begin{array}{c}A\\ \Delta \,\|\, S\\ B\end{array}}{\rho\,C}$$

```
\vlderivation            {
\vlin{\rho  }{      }{C} {
\vlde{\Delta}{\cal S}{B}{
\vlhy                {A}}}}
```

---

$$\begin{array}{c}A\\ \Delta \,\|\, S''\\ B\\ \Delta' \,\|\, S'\\ C\\ \Delta'' \,\|\, S\\ D\end{array}$$

```
\vlderivation                  {
\vlde{\Delta''}{\cal S  }{D}  {
\vlde{\Delta' }{\cal S' }{C} {
\vlde{\Delta  }{\cal S''}{B}{
\vlhy                    {A}}}}}
```

---

$$\begin{array}{c}\rho\,\dfrac{A}{B}\\ \Delta \,\|\\ C\\ \Delta' \,\|\\ D\end{array}$$

```
\vlderivation        {
\vlde{\Delta'}{}{D}  {
\vlde{\Delta }{}{C} {
\vlin{\rho   }{}{B}{
\vlhy          {A}}}}}
```

---

$$\begin{array}{c}A\\ \rho\,\vdots\\ B\\ \rho'\,\dfrac{\dfrac{}{}}{C}\\ \rho''\,\dfrac{}{D}\end{array}\quad .$$

```
\vlderivation             {
\vlin{\rho''}{\quad.}{D}  {
\vliq{\rho' }{      }{C} {
\vlid{\rho  }{      }{B}{
\vlhy                {A}}}}}
```

---

$$\rho\,\dfrac{\begin{array}{c}A \wedge A'\\ \Delta \,\|\\ C \wedge C'\\ \Delta' \,\|\\ D \wedge D'\end{array}\qquad \begin{array}{c}A \wedge A'\\ \rho\,\dfrac{}{B \wedge B'}\\ \rho'\,\dfrac{}{C \wedge C'}\\ \rho''\,\dfrac{}{D \wedge D'}\ \star\end{array}}{E \wedge E'}\ \star$$

```
\vlderivation                          {
\vliiq{\rho   }{\star}{\vls(E.E')}   {
\vlde {\Delta'}{     }{\vls(D.D')}  {
\vlde {\Delta }{     }{\vls(C.C')} {
\vlin {\rho   }{     }{\vls(B.B')}{
\vlhy                  {\vls(A.A')}}}}}
                                       {
\vlin {\rho'' }{\star}{\vls(D.D')}  {
\vlin {\rho'  }{     }{\vls(C.C')} {
\vlin {\rho   }{     }{\vls(B.B')}{
\vlhy                  {\vls(A.A')}}}}}
```

Note `\vlvdots` in

$$\begin{array}{c}\gamma\\ \|\\ \alpha_1\\ \tau\,\dfrac{}{\alpha_1\sigma_1}\\ \|\\ \vdots\\ \|\\ \alpha_n\\ \rho\,\dfrac{}{\alpha_n\sigma_n}\\ \|\\ \beta\end{array}$$

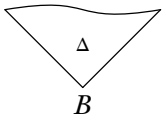
```
\vlderivation                        {
\vlde{    }{}{\beta          }     {
\vlin{\rho}{}{\alpha_n\sigma_n}    {
\vlde{    }{}{\alpha_n       }   {
\vlde{    }{}{\vlvdots       }  {
\vlin{\tau}{}{\alpha_1\sigma_1} {
\vlde{    }{}{\alpha_1       }{
\vlhy        {\gamma          }}}}}}}
```

The command \vlx provides some extra space, as in

$$\xi\left\{\begin{array}{c}\alpha\\ \Psi\|\\ \dfrac{\dfrac{t}{a\vee\bar{a}}\wedge(\bar{a}\vee\bar{a})}{\left(\begin{array}{c}\dfrac{\dfrac{a}{a\wedge a}\wedge(\bar{a}\vee\bar{a})}{a\wedge((a\wedge\bar{a})\vee\bar{a})}\ \vee\ \bar{a}\\ \dfrac{a\wedge\bar{a}}{f}\vee\dfrac{a\wedge\bar{a}}{f}\end{array}\right)}\\ \Psi'\|\\ \beta\end{array}\right\}$$

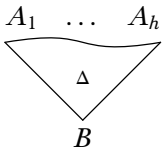
```
\vlderivation                                          {
\vldd{\Psi'}{}\beta                                   {
\vldd\Psi   {}{\xi{\left\{
%-------------------
\vlinf{}
      {}
      {\vlsbr[\vlderivation                          {
              \vlin{}{}{\vls[\vlinf{}
                                    {}
                                    f
                                    {\vls(a.-a)}
                                 .\vlinf{}
                                    {}
                                    f
                                    {\vls(a.-a)}
                                 ]                  } {
              \vlin{}{}{\vls(a.[(a.-a).-a])}{
              \vlhy    {\vls(\vlinf{}
                                    {}
                                    {\vls(a.a)}
                                    a
                                 .[-a. -a]
                                 )                  }}}}
            \vlx.\vlx
             {-a}
            ]                                            }
      {\vls(\vlinf{}{}{\vls[a.-a]}t.[-a.-a])}
%-------------------
                        \right\}}                     }{
\vlhy         \alpha                                   }}}
```

The following use XY-pic (see at the beginning of this manual for instructions).



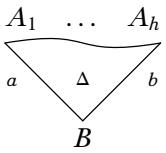

```
\vlderivation        {
\vltr{\Delta}{B    }{
\vlhy        {A_1  }}
                     {
\vlhy        {\dots}}
                     {
\vlhy        {A_h  }}}
```

---



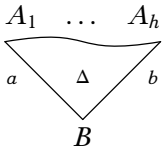

```
\vltreeder{\Delta}{B}{A_1}{\dots}{A_h}
```

---



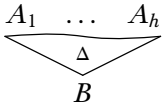

```
\vlderivation               {
\vltrl{\Delta}{a}{b}{B    }{
\vlhy               {A_1  }}
                            {
\vlhy               {\dots}}
                            {
\vlhy               {A_h  }}}
```

---



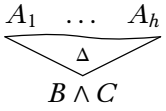

```
\vltreederl{\Delta}{a}{b}{B}{A_1}{\dots}{A_h}
```

---



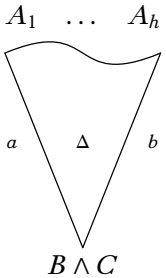

```
{\vlnostructuressyntax
\vlderivation         {
\vltrf{\Delta}{B    }{
\vlhy         {A_1  }}
                      {
\vlhy         {\dots}}
                      {
\vlhy         {A_h  }}
                 {0.5}}}
```

---

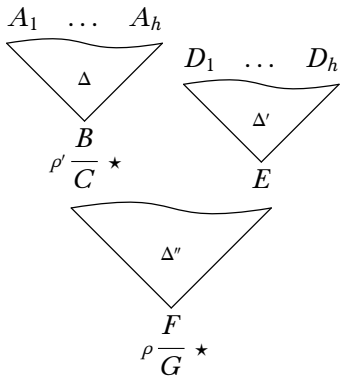



```
\toks0={0.5}
\vlderivation             {
\vltrf{\Delta}{\vls(B.C)}{
\vlhy         {A_1      }}
                          {
\vlhy         {\dots    }}
                          {
\vlhy         {A_h      }}
              {\the\toks0}}
```

---

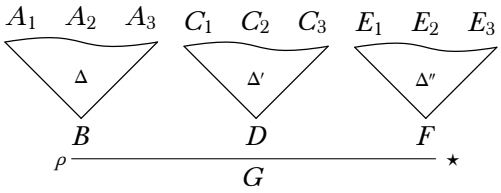



```
\toks0={2.5}
\vlderivation                    {
\vltrlf{\Delta}{a}{b}{\vls(B.C)}{
\vlhy                {A_1      }}
                                 {
\vlhy                {\dots    }}
                                 {
\vlhy                {A_h      }}
                     {\the\toks0}}
```

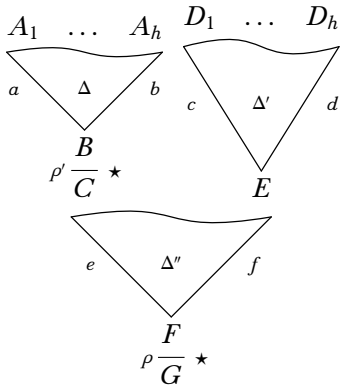



```
\dimen0=-1pc
\vlderivation                                {
\vlin{\rho    }{\star}{G           }   {
\vltr{\Delta''}       {F           }  {
\vlin{\rho'   }{\star}{C           } {
\vltr{\Delta  }       {B           }{
\vlhy                 {A_1         }}
                                    {
\vlhy                 {\dots       }}
                                    {
\vlhy                 {A_h         }}}}
                                      {
\vlhy                 {\kern\dimen0} }
                                      {
\vltr{\Delta' }       {E           }{
\vlhy                 {D_1         }}
                                    {
\vlhy                 {\dots       }}
                                    {
\vlhy                 {D_h         }} }}}
```

---



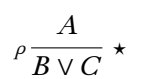

```
\vlderivation                    {
\vliiin{\rho    }{\star}{G  } {
\vltr  {\Delta  }       {B  }{
\vlhy                   {A_1}}
                             {
\vlhy                   {A_2}}
                             {
\vlhy                   {A_3}}}
                              {
\vltr  {\Delta' }       {D  }{
\vlhy                   {C_1}}
                             {
\vlhy                   {C_2}}
                             {
\vlhy                   {C_3}}}
                            {
\vltr  {\Delta''}       {F  }{
\vlhy                   {E_1}}
                             {
\vlhy                   {E_2}}
                             {
\vlhy                   {E_3}}}}
```



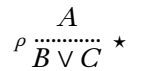

```
{\vlnostructuressyntax
\vlderivation                              {
\vlin  {\rho    }{\star}{G        }   {
\vltrl {\Delta''}{e}{f} {F        }  {
\vlin  {\rho'   }{\star}{C        } {
\vltrl {\Delta  }{a}{b} {B        }{
\vlhy                   {A_1      }}
                                    {
\vlhy                   {\dots    }}
                                    {
\vlhy                   {A_h      }}}}
                                      {
\vlhy                   {\kern-1pc}  }
                                      {
\vltrlf{\Delta' }{c}{d} {E        }{
\vlhy                   {D_1      }}
                                    {
\vlhy                   {\dots    }}
                                    {
\vlhy                   {D_h      }}
                                  {1.6}}}}}
```

## 5. Open Deduction

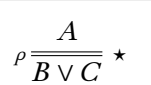
The following macros for open deduction do not reverse the order of formulae.



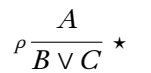
```
\od{\odi{\odh
    {A    }          }
{\rho}{[B.C]}{\star}}
```



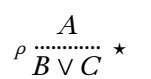
```
\od{\odo{\odh
    {A    }          }
{\rho}{[B.C]}{\star}}
```



```
\od{\odI{\odh
    {A    }          }
{\rho}{[B.C]}{\star}}
```



```
\odn{A}{\rho}{[B.C]}{\star}
```

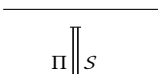


```
\odt{A}{\rho}{[B.C]}{\star}
```

```
\odN{A}{\rho}{[B.C]}{\star}
```

```
\od{\odp
{\Pi}{[B.C]}{\cal S}}
```

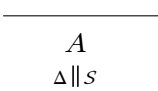
```
\od{\odP
{\Pi}{[B.C]}{\cal S}}
```



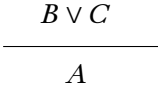
```
\toks0={3.2}
                    \od{\odpx
{\Pi}{[B.C]}{\cal S}{\the\toks0}}
```

```
\odr{\Pi}{[B.C]}{\cal S}
```

```
\odR{\Pi}{[B.C]}{\cal S}
```

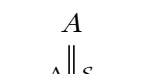


```
\od{\odd{\odh
    {A    }          }
{\Delta}{[B.C]}{\cal S}}
```

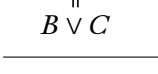


```
\od{\odD{\odh
    {A    }          }
{\Delta}{[B.C]}{\cal S}}
```

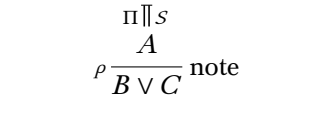
```
\toks0={2.5}
                    \od{\oddx{\odh
    {A    }                   }
{\Delta}{[B.C]}{\cal S}{\the\toks0}}
```



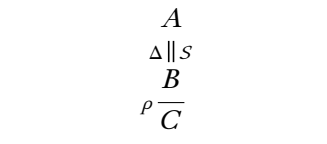
```
\odv{A}{\Delta}{[B.C]}{\cal S}
```



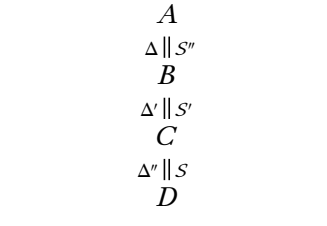
```
\odV{A}{\Delta}{[B.C]}{\cal S}
```



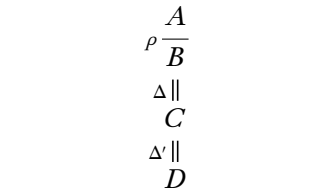
```
\od{\odi{\odp
{\Pi }{A    }{\cal S  }     }
{\rho}{[B.C]}{\rm note}}
```



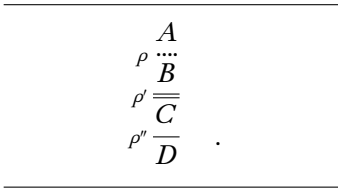
```
\od{\odi{\odd{\odh
        {A}                 }
{\Delta}{B}{\cal S}     }
{\rho  }{C}{      }}
```



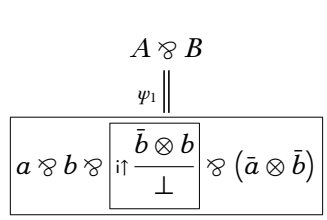
```
\od{\odd{\odd{\odd{\odh
          {A}                          }
{\Delta  }{B}{\cal S''}          }
{\Delta' }{C}{\cal S' }     }
{\Delta''}{D}{\cal S  }}
```



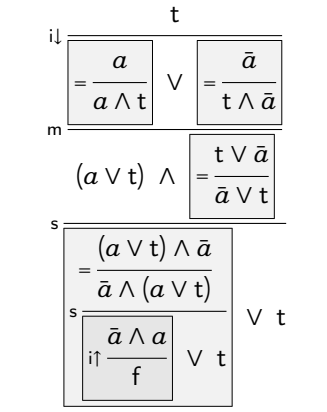
```
\od{\odd{\odd{\odi{\odh
         {A}                 }
{\rho   }{B}{}          }
{\Delta }{C}{}     }
{\Delta'}{D}{}}
```



```
\od{\odi{\odI{\odo{\odh
        {A}                         }
{\rho  }{B}{      }         }
{\rho' }{C}{      }     }
{\rho''}{D}{\quad.}}
```



```
    \odV{[A;B]}
{\psi_1}{\odbox{[a;b
                ;
                \odn{(-b;b)}
                 \iU\bot    {}
                ;
                (-a;-b)
               ]              }}{}
```

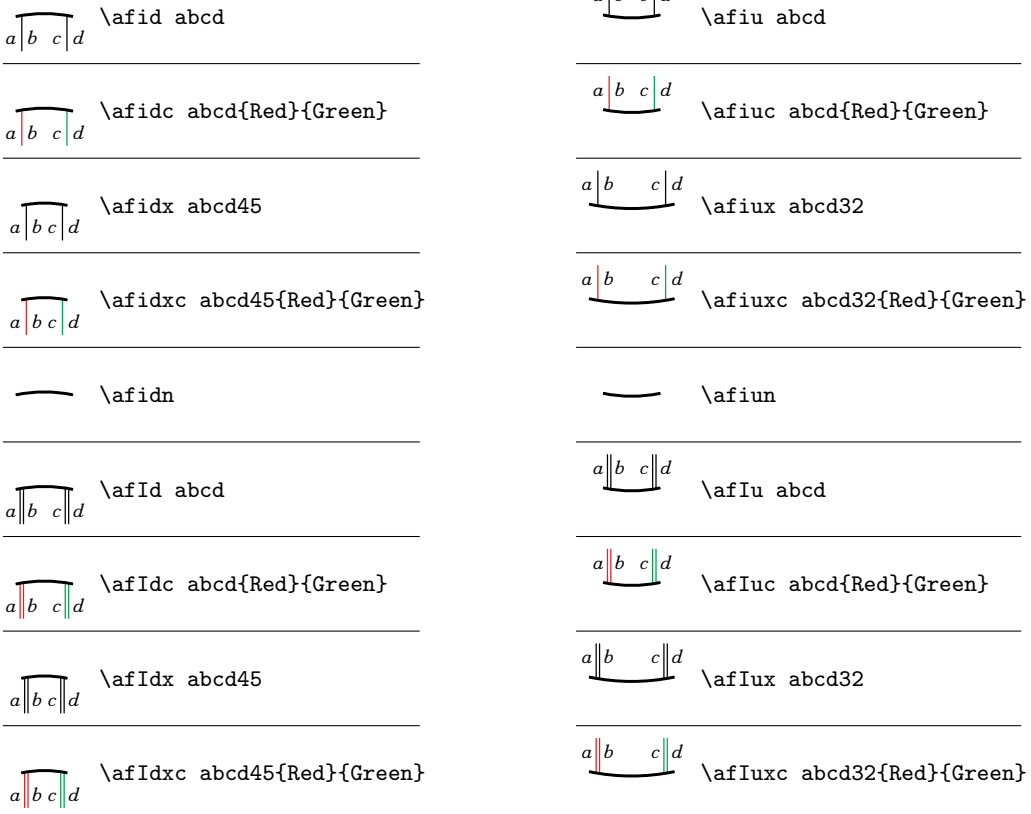


```
\odbackgroundtrue
                        \od{\odi{\odi{\odi{\odh
   {\ttt                                    }  }
\iD{[\odn{ a    }
        ={(a.\ttt)}{}..\odn{    -a }
                        ={(\ttt.-a)}{}]   }{}}
\me{([a.\ttt]..\odn{[\ttt.-a]}
                ={[-a.\ttt]}{})           }{}}
\sw{[         \od{\odi{\odi{\odh
        {([a.\ttt].-a)         }  }
       ={(-a.[a.\ttt])         }{}}
     \sw{[\odn{(-a.a)}
           \iU{\fff  }{}..\ttt]}{}}..\ttt]}{}}
```

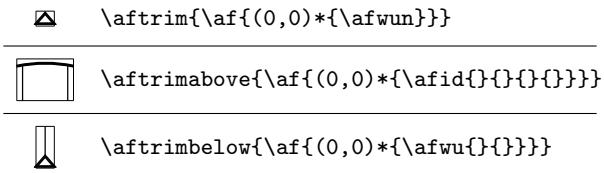
You can suppress or enable the background colour and the frames, respectively, with the commands `\odbackgroundfalse` or `\odbackgroundtrue`, and `\odframefalse` or `\odframetrue`.

## 6. Atomic Flows

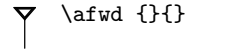
The following uses XY-pic (see at the beginning of this manual for instructions).

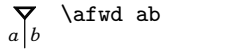


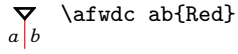

The three macros `\aftrim`, `\aftrimabove` and `\aftrimbelow` trim extra space above and below diagrams including `\afiu` and similar macros.

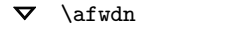


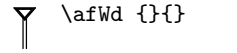

Use the macros `\afraise` and `\aflower`, typically with one atomic flow as an argument, to raise or lower a bit the atomic flow (see examples in the following).

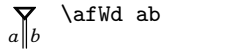

\afwd {}{}

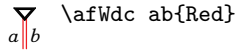

\afwd ab

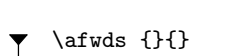

\afwdc ab{Red}

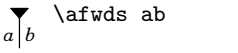

\afwdn

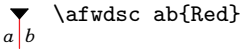

\afWd {}{}

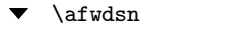

\afWd ab

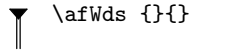

\afWdc ab{Red}

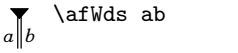

\afwds {}{}

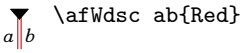

\afwds ab

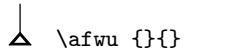

\afwdsc ab{Red}

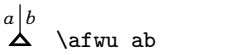

\afwdsn

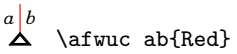

\afWds {}{}

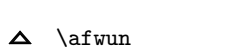

\afWds ab


\afWdsc ab{Red}


\afwu {}{}


\afwu ab


\afwuc ab{Red}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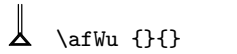
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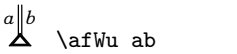
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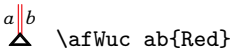
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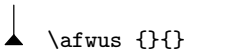
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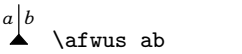
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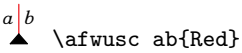
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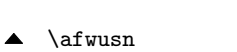
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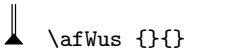
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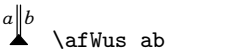
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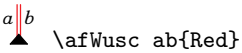
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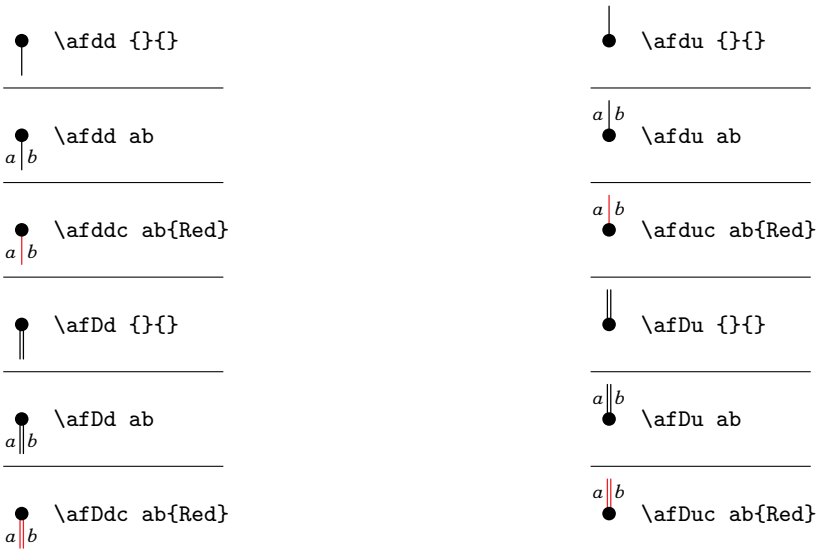
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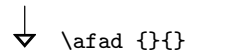
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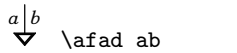
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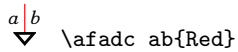
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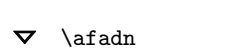
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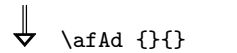
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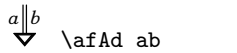
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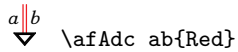
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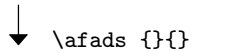
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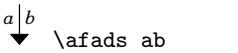
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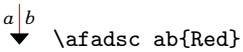
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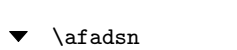
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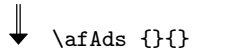
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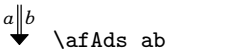
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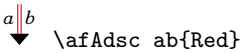
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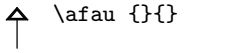
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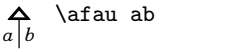
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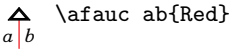
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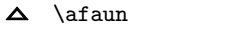
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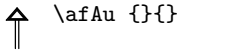
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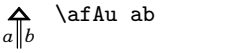
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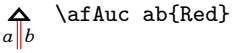
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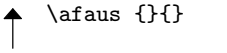
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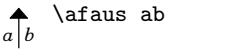
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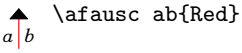
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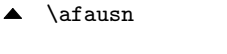
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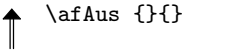
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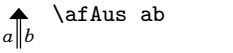
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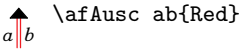
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                {Blue}
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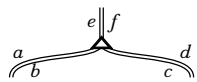


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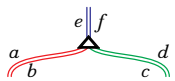


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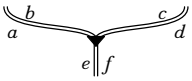


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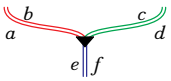


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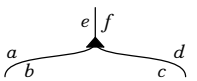


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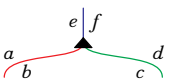


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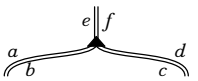


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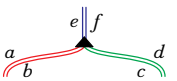


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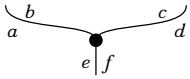


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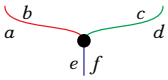


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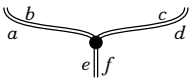


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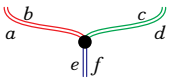


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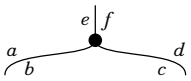


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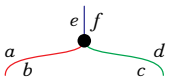


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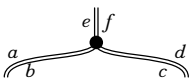


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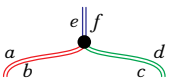


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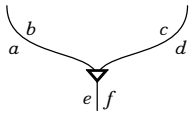


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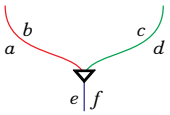


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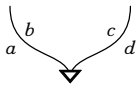


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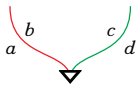


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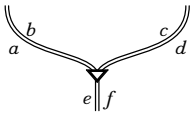


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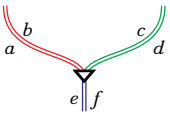


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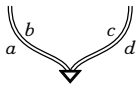


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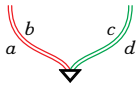


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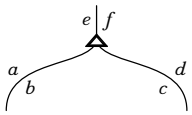


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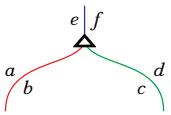


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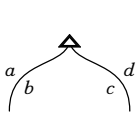


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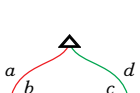


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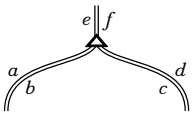


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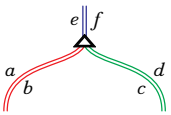


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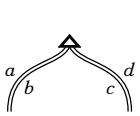


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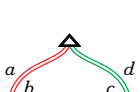


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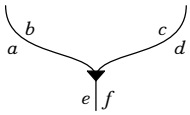


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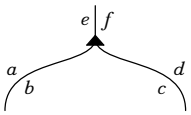


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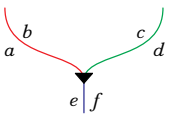


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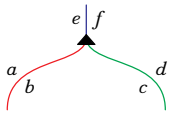


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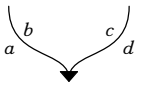


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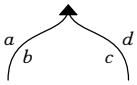


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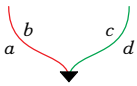


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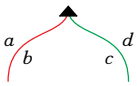


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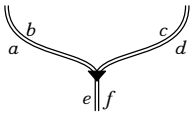


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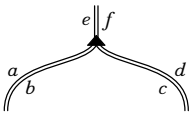


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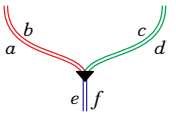


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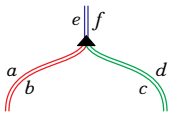


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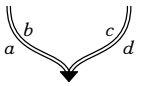


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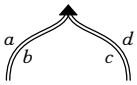


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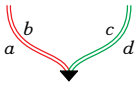


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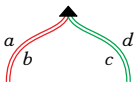


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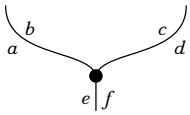


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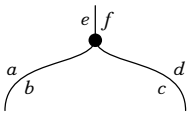


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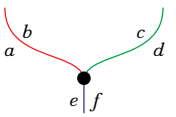


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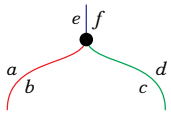


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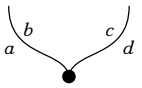


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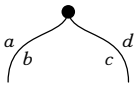


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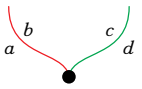


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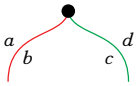


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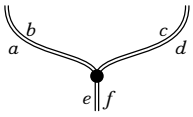


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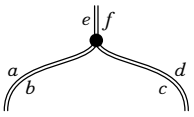


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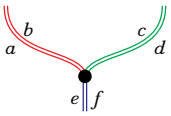
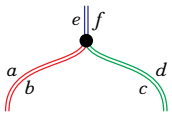
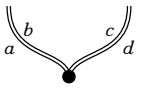
\afCudX abcdef41
```



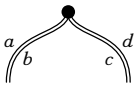

```
\afCddXc abcdef72{Red}
                 {Green}
                 {Blue}
```



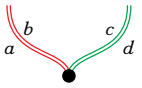

```
\afCudXc abcdef72{Red}
                 {Green}
                 {Blue}
```



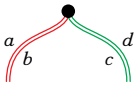

```
\afCddnX abcd83
```



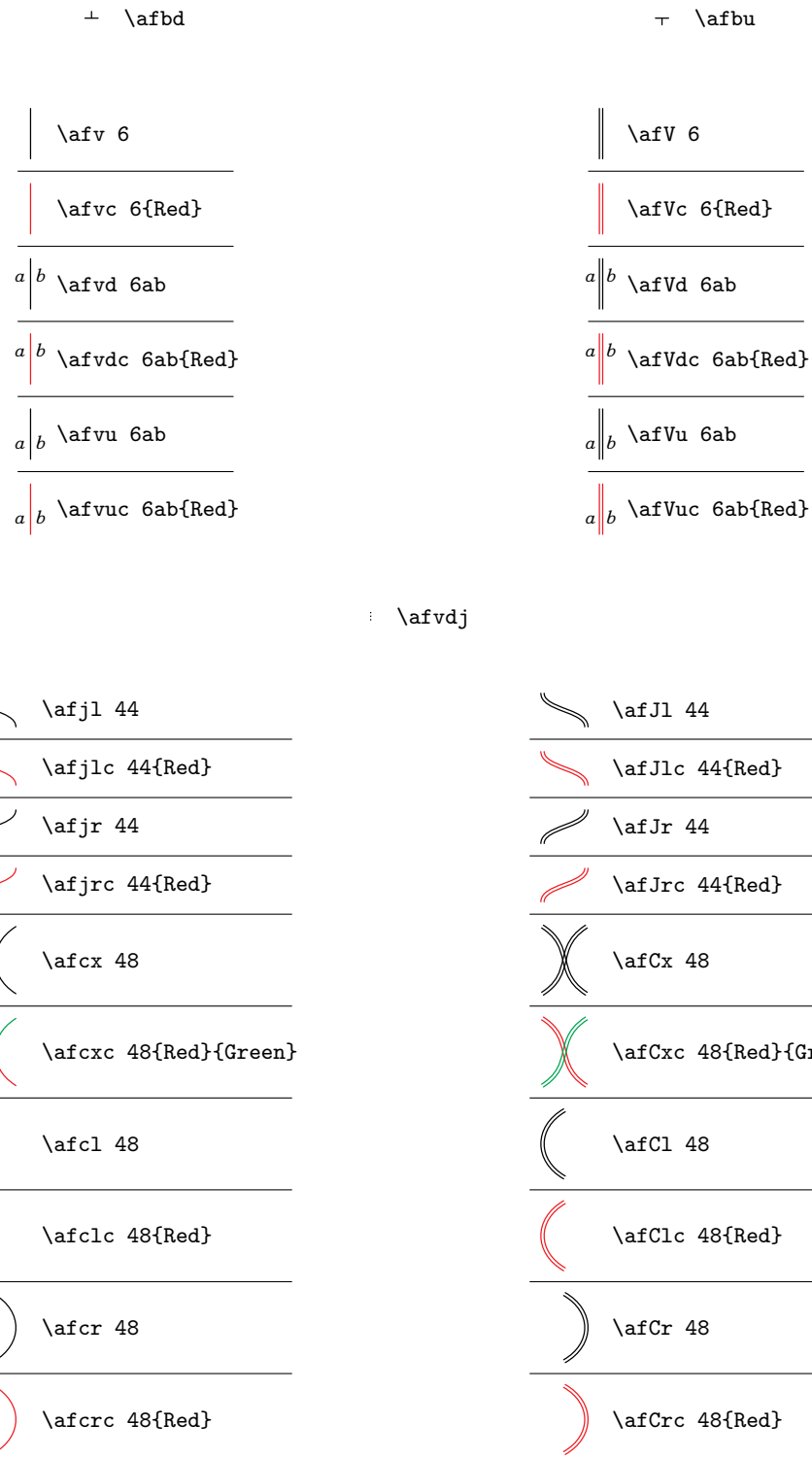

```
\afCudnX abcd83
```




```
\afCddnXc abcd83{Red}
                 {Green}
```




```
\afCudnXc abcd83{Red}
                 {Green}
```


\afbd
\afbu
\afv 6
\afV 6
\afvc 6{Red}
\afVc 6{Red}
a b \afvd 6ab
a b \afVd 6ab
a b \afvdc 6ab{Red}
a b \afVdc 6ab{Red}
a b \afvu 6ab
a b \afVu 6ab
a b \afvuc 6ab{Red}
a b \afVuc 6ab{Red}
\afvdj
\afjl 44
\afJl 44
\afjlc 44{Red}
\afJlc 44{Red}
\afjr 44
\afJr 44
\afjrc 44{Red}
\afJrc 44{Red}
\afcx 48
\afCx 48
\afcxc 48{Red}{Green}
\afCxc 48{Red}{Green}
\afcl 48
\afCl 48
\afclc 48{Red}
\afClc 48{Red}
\afcr 48
\afCr 48
\afcrc 48{Red}
\afCrc 48{Red}
\afex 44
\afexc 44{Red}{Green}
\afexpu 542
\afexpd 825
\affr 84
\affrb 48

By default the background colour is defined as `\newxycolor{afbackground}{0 0 0 0.12 cmyk}`.

The following `dimen` parameters are defined:

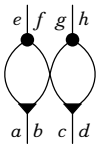
```
\afelwidth        =425\afunit
\afelheight       =325\afunit
\afthickone       = 40\afunit
\afthicktwo       = 40\afunit
\afthickthree     =120\afunit
\afthickfour      = 40\afunit
\aflabeldistance  =220\afunit
```

The registers govern various parameters in the atomic flow elements (experiment to see which ones). You might be interested especially in changing the last one. The parameters can be globally scaled by invoking `\afsetparams` after having adjusted `\afunit`, which by default is 0.01pt. The parameters `\afthickone` and `\afthickthree` are not effective in `pdflatex`.

Each line starting with a coordinate pair $(x, y)$ is an element of the figure. The coordinates are relative, so, for example, you can add or subtract the same vector to all of them and still get the same figure.

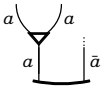

```
\af{
(0,8)*{\afcd a{}{}a{}{}};
(0,0)*{\afcu a{}{}a{}{}}}
```

---



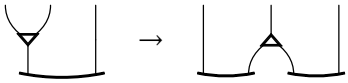

```
\af{
(0,0)*{\afwds ab};
(4,0)*{\afwds cd};
(0,8)*{\afdu  ef};
(4,8)*{\afdu  gh};
(2,4)*{\afcx  48};
(0,4)*{\afcl  48};
(4,4)*{\afcr  48}}
```

---



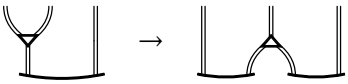

```
\af{
(4,4.5)*{\afvdj};
(0,5  )*{\afcd a{}{}a{}{}};
(2,0  )*{\afiu a{}{}{\bar a}}}
```

---



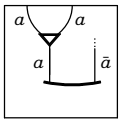
```
\aflower{\af{
(   6, 6)*{\afvd4{}{}{}{}};
(   3, 0)*{\afiux{}{}{}{}32};
(   0, 4)*{\afcdn{}{}{}{}}}}
\quad\to\quad
\aflower{\af{
(   6,6)*{\afcu{}{}{}{}{}{}};
(   0,6)*{\afvd8{}{}};
(  12,6)*{\afvd8{}{}};
(  10,2)*{\afiun};
(   2,2)*{\afiun}}}
```

---



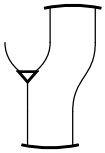
```
\aflower{\af{
(   6, 6)*{\afVd4{}{}{}{}};
(   3, 0)*{\afIux{}{}{}{}32};
(   0, 4)*{\afCdn{}{}{}{}}}}
\quad\to\quad
\aflower{\af{
(   6,6)*{\afCu{}{}{}{}{}{}};
(   0,6)*{\afVd8{}{}};
(  12,6)*{\afVd8{}{}};
(  10,2)*{\afiun};
(   2,2)*{\afiun}}}
```

---



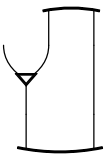

```
\af{
(4,4.5)*{\afvdj};
(0,5  )*{\afcd a{}{}a{}{}};
(1,2.5)*{\affr{10}{13}};
(2,0  )*{\afiu a{}{}{\bar a}}}
```

---

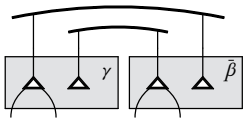


```
\af{
(4,16)*{\afid{}{}{}{}{}{}};
(0, 8)*{\afcd{}{}{}{}{}{}};
(5, 8)*{\afjr28};
(2, 0)*{\afiu{}{}{}{}}}
```

---

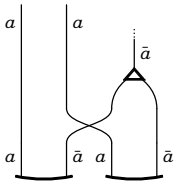


```
{\af{
(4,16)*{\afid{}{}{}{}{}{}};
(0, 8)*{\afcd{}{}{}{}{}{}};
(6, 8)*{\afv8};
(3, 0)*{\afiux{}{}{}{}32}}}
```

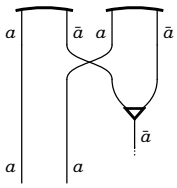



```
\af                                          {
( 2  ,6  )*{\afidxc{}{}{}{}74{white}{white}};
(-1.5,5  )*{\afv2}                           ;
( 5.5,5  )*{\afv2}                           ;
( 2  ,8  )*{\afidx{}{}{}{}{15}4}             ;
( 8  ,0  )*{\affrb{10}6}                     ;
(13  ,1.5)*{\afll{\bar\beta}}                ;
( 9.5,0  )*{\afwu{}{}}                       ;
( 5.5,0  )*{\afcu{}{}{}{}{}{}}               ;
(-3  ,0  )*{\affrb{10}6}                     ;
( 2  ,1.5)*{\afll\gamma}                     ;
(-1.5,0  )*{\afwu{}{}}                       ;
(-5.5,0  )*{\afcu{}{}{}{}{}{}}               }
```

In the next two figures, notice how vertical symmetry is achieved:

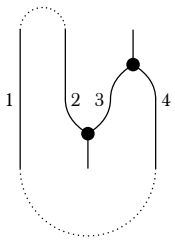



```
\af{
(10,20.5)*{\afvdj};
( 4,18  )*{\afvd{12}{}a};
( 0,16  )*{\afvd{16}a{}};
(10,16  )*{\afcu{}{}{}{}{}
                  {\bar a}};
( 6,10  )*{\afex44};
(12,10  )*{\afv4};
( 2, 4  )*{\afiu a{}{}
             {\bar a}};
(10, 4  )*{\afiu a{}{}
            {\bar a}}}
```

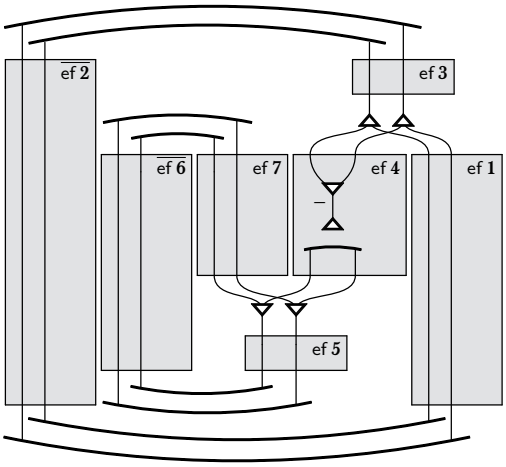



```
\afinv{
(10,20.5)*{\afvdj};
( 4,18  )*{\afvu{12}{}a};
( 0,16  )*{\afvu{16}a{}};
(10,16  )*{\afcd{}{}{}{}{}
                  {\bar a}};
( 6,10  )*{\afex44};
(12,10  )*{\afv4};
( 2, 4  )*{\afid a{}{}
             {\bar a}};
(10, 4  )*{\afid a{}{}
            {\bar a}}}
```

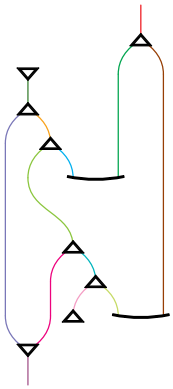
The following figure requires `\xyoption{arc}`:




```
\af{
(10,12)*{\afcud{}{}{}{}{}{}};
( 6, 4)*{\afcdd{}{}{}{}{}{}};
( 4,12)*{\afv8};
(12, 4)*{\afv8};
( 0, 8)*{\afv{16}{}{}};
( 0, 8)*{\afll1};
( 4, 8)*{\aflr2};
( 8, 8)*{\afll3};
(12, 8)*{\aflr4};
( 0,16);(4,16),{\ellipse_{.}};
(12, 0);(0, 0),{\ellipse_{.}}}
```

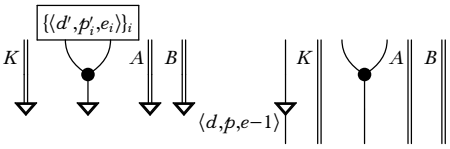



```
\renewcommand{\one  }{{\bf\scriptstyle 1}}
  \newcommand{\two  }{{\bf\scriptstyle 2}}
  \newcommand{\three}{{\bf\scriptstyle 3}}
  \newcommand{\four }{{\bf\scriptstyle 4}}
  \newcommand{\five }{{\bf\scriptstyle 5}}
  \newcommand{\six  }{{\bf\scriptstyle 6}}
  \newcommand{\seven}{{\bf\scriptstyle 7}}
  \newcommand{\ef}{\mathop{\mathsf{ef}}}
\af                                          {
(  1.5  ,  4  )*{\affrb{10}{14}}             ;
(  0    ,  3  )*{\afwu-{}}                   ;
(  0    ,  0  )*{\afidn}                     ;
(  6.5  ,  9.5)*{\afll{\ef\four}}            ;
(  0    ,  7  )*{\afcdn{}{}{}{}}             ;
(- 2    ,- 1.5)*{\afv3}                      ;
(  2    ,- 1.5)*{\afv3}                      ;
(- 8    ,  4  )*{\affrb8{14}}                ;
(-10.5  ,  3  )*{\afv{12}}                   ;
(- 8.5  ,  4  )*{\afv{14}}                   ;
(- 4    ,  9.5)*{\afll{\ef\seven}}           ;
(-11.625,-16  )*{\afiuxc{}{}{}{}{10}4
                          {white}{white}}    ;
(-11.125,-18  )*{\afiuxc{}{}{}{}{59}{16}
                          {white}{white}}    ;
(- 3.25 ,-12  )*{\affrb94}                   ;
(- 6.25 ,-13.5)*{\afv5}                      ;
(- 3.25 ,-14.5)*{\afv7}                      ;
(  1.25 ,-11.5)*{\afll{\ef\five}}            ;
(- 6.25 ,- 7  )*{\afcdx{}{}{}{}{}{}{17}8}   ;
(- 3.25 ,- 7  )*{\afcdx{}{}{}{}{}{}{21}8}   ;
(-10.625, 26.8)*{\afidxc{}{}{}{}{59}8
                           {white}{white}}   ;
(-11.125, 24.8)*{\afidxc{}{}{}{}{101}{16}
                           {white}{white}}   ;
(- 8.5  ,-22.8)*{\afiuxc{}{}{}{}{33}4
                         {white}{white}}     ;
(- 8.5  ,-20.5)*{\afiuxc{}{}{}{}{59}8
                         {white}{white}}     ;
(-16.5  ,- 1.5)*{\affrb8{25}}                ;
(-19    ,- 3.5)*{\afv{29}}                   ;
(-17    ,- 3.5)*{\afv{25}}                   ;
(-12.5  ,  9.5)*{\afll{\overline{\ef\six}}};
(-13.75 , 13  )*{\afidx{}{}{}{}{13}8}        ;
(-13.75 , 15  )*{\afidx{}{}{}{}{21}8}        ;
( 11    , -3.5)*{\affrb8{29}}                ;
(  8.5  , -4.5)*{\afv{31}}                   ;
( 10.5  , -5.5)*{\afv{33}}                   ;
( 15    ,  9.5)*{\afll{\ef\one}}             ;
(  3.25 , 15  )*{\afcux{}{}{}{}{}{}{21}8}    ;
(  6.25 , 15  )*{\afcux{}{}{}{}{}{}{17}8}    ;
(  6.25 , 20  )*{\affrb94}                   ;
(  3.25 , 21  )*{\afv6}                      ;
(  6.25 , 22  )*{\afv8}                      ;
( 10.75 , 20.5)*{\afll{\ef\three}}           ;
(-25    ,  2  )*{\affrb8{40}}                ;
(-27.5  ,  2  )*{\afv{48}}                   ;
(-25.5  ,  2  )*{\afv{44}}                   ;
(-21    , 20.5)*{\afll{\overline{\ef\two}}}}}
```

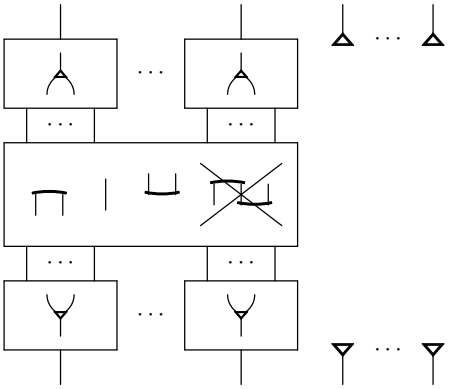


```
\af{
( 7,20)*{\afvc{28}{RawSienna}};
(-3, 8)*{\afvc{4}{RubineRed}};
(-2,20)="A";
"A"+( 5, 8)*{\afvc{12}{Green}};
"A"+(-3,10)*{\afcuc{}{}{}{}{}{}{Periwinkle}
                                {YellowOrange}
                                {OliveGreen}};
"A"+(-1, 6)*{\afcunc{}{}{}{}{LimeGreen}
                             {ProcessBlue}};
"A"+( 3, 2)*{\afiun};
"A"+(-5,-4)*{\afvc{20}{Periwinkle}};
"A"+(-3,14)*{\afwdn};
(-3,18)*{\afjlc48{LimeGreen}};
(-1,14)*{\afcunc{}{}{}{}{RubineRed}
                           {Aquamarine}};
( 1,10)*{\afcunc{}{}{}{}{Lavender}
                           {SpringGreen}};
( 5, 6)*{\afiun};
(-1, 6)*{\afwun};
( 5,38)*{\afcuc{}{}{}{}{}{}{Green}
                             {RawSienna}
                             {Red}};
(-5, 2)*{\afcdc{}{}{}{}{}{}{Periwinkle}
                             {RubineRed}
                             {DarkOrchid}}}
```

---



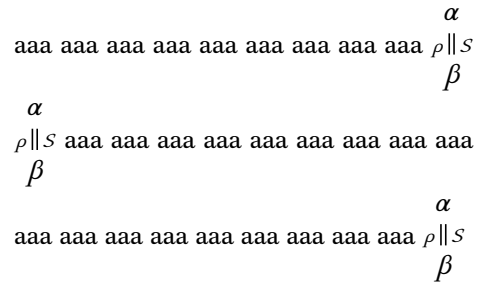

```
\af{
(-1  , 4  )*{\afAd{}{}                        };
(-1  ,10  )*{\afVd4K{}                        };
( 4.5,14  )*{\affr94                          };
( 4.5,14  )*{\strut\scriptstyle
               \{\langle d',p'_i,e_i\rangle\}_i};
( 4.5, 8  )*{\afcdd{}{}{}{}{}{}               };
( 4.5, 4  )*{\afadn                           };
(10  , 4  )*{\afAd{}{}                        };
(10  ,10  )*{\afVd4A{}                        };
(13  , 4  )*{\afAd{}{}                        };
(13  ,10  )*{\afVd4B{}                        };
(22  , 2  )*{\afv4                            };
(22  , 4  )*{\afad{}{}                        };
(22  ,10  )*{\afv4                            };
(22  , 2.5)*{\afll{\strut\scriptstyle
               \langle d,p,e-1\rangle}        };
(25  , 6  )*{\afVd{12}K{}                     };
(29  , 2  )*{\afv4                            };
(29  , 8  )*{\afcdd{}{}{}{}{}{}               };
(33  , 6  )*{\afVd{12}A{}                     };
(36  , 6  )*{\afVd{12}B{}                     }}
```



```
{
\newbox\boxone\setbox\boxone=\hbox{$
   \divide  \afunit by5
   \multiply\afunit by3\afsetparams
   \af{(0,0)*{\afcd{}{}{}{}{}{}}}$}
\newbox\boxtwo\setbox\boxtwo=\hbox{$
   \divide  \afunit by5
   \multiply\afunit by3\afsetparams
   \af{(0,0)*{\afid{}{}{}{}{}{}}}$}
\newbox\boxthree\setbox\boxthree=\hbox{$
   \divide  \afunit by5
   \multiply\afunit by3\afsetparams
   \af{(0,0)*{\afiu{}{}{}{}{}{}}}$}
\newbox\boxfour\setbox\boxfour=\hbox{$
   \divide  \afunit by5
   \multiply\afunit by3\afsetparams
   \af{(0,0)*{\afv6}}$}
\newbox\boxfive\setbox\boxfive=\hbox{$
   \divide  \afunit by5
   \multiply\afunit by3\afsetparams
   \af{(0,0)*{\afcu{}{}{}{}{}{}}}$}
\newbox\boxsix\setbox\boxsix=\hbox{$
   \divide  \afunit by5
   \multiply\afunit by3\afsetparams
   \af{(4, 8)*{\afidn{}{}};
            (2, 6)*{\afvd4{}{}};
            (8, 4)*{\afiu{}{}{}{}{}{}};
            (0, 0);(12,12)**[|<\afthickone>]@{-};
            (0,12);(12, 0)**[|<\afthickone>]@{-}}$}
\af{
( 3,40)*{\afv4};          (19,40)*{\afv4};
(28,38)*{\afwu{}{}};      (32,38)*{\cdots};
(36,38)*{\afwu{}{}};      (11,34)*{\cdots};
(19,34)*{\affr{10}8};     (19,34)*{\copy\boxfive};
( 3,34)*{\affr{10}8};     ( 3,34)*{\copy\boxfive};
( 0,28)*{\afv4};          ( 3,28)*{\cdots};
( 6,28)*{\afv4};          (16,28)*{\afv4};
(19,28)*{\cdots};         (22,28)*{\afv4};
( 2,20)*{\copy\boxtwo};   ( 7,20)*{\copy\boxfour};
(11,20)*{\affr{26}{12}}; (12,20)*{\copy\boxthree};
(19,20)*{\copy\boxsix};   ( 0,12)*{\afv4};
( 3,12)*{\cdots};         ( 6,12)*{\afv4};
(16,12)*{\afv4};          (19,12)*{\cdots};
(22,12)*{\afv4};          ( 3,6 )*{\affr{10}8};
( 3,6 )*{\copy\boxone};   (11,6 )*{\cdots};
(19,6 )*{\affr{10}8};     (19,6 )*{\copy\boxone};
(28,2 )*{\afwd{}{}};      (32,2 )*{\cdots};
(36,2 )*{\afwd{}{}};      ( 3,0 )*{\afv4};
(19,0 )*{\afv4}}}
```

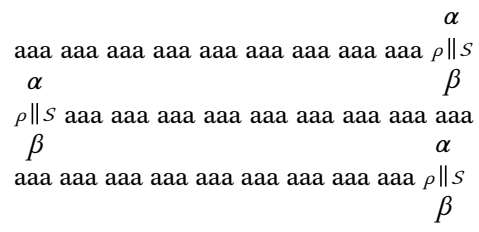
## 7. Smash macros

Compare:



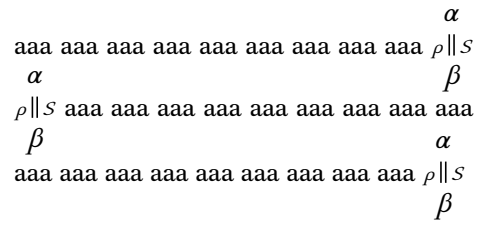
```
aaa aaa aaa aaa aaa aaa aaa aaa aaa $\vlder{\rho}{\cal S}{\beta}{\alpha}$
$\vlder{\rho}{\cal S}{\beta}{\alpha}$ aaa aaa aaa aaa aaa aaa aaa aaa aaa
aaa aaa aaa aaa aaa aaa aaa aaa aaa $\vlder{\rho}{\cal S}{\beta}{\alpha}$
```

---



```
aaa aaa aaa aaa aaa aaa aaa aaa aaa
$\vldownsmash
 {\vlder{\rho}{\cal S}{\beta}{\alpha}}$
$\vlder{\rho}{\cal S}{\beta}{\alpha}$ aaa aaa aaa aaa aaa aaa aaa aaa aaa
aaa aaa aaa aaa aaa aaa aaa aaa aaa
aaa aaa aaa aaa aaa aaa aaa aaa aaa $\vlupsmash{\vlder{\rho}{\cal S}{\beta}{\alpha}}$
```

---



```
aaa aaa aaa aaa aaa aaa aaa aaa aaa
$\vlder{\rho}{\cal S}{\beta}{\alpha}$
$\vlsmash{\vlder{\rho}{\cal S}{\beta}{\alpha}}$ aaa aaa aaa aaa aaa aaa aaa aaa aaa
aaa aaa aaa aaa aaa aaa aaa aaa aaa
aaa aaa aaa aaa aaa aaa aaa aaa aaa $\vlder{\rho}{\cal S}{\beta}{\alpha}$
```

## 8. Acknowledgements

Many thanks to Ross Moore for suggestions leading to `\vlupdate` and to Peter Wilson for allowing me to include the code of `ifmtarg.sty`.

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