In[2]:=
```
Needs["General`Lorentz`"]
```

General`Lorentz` loaded. Click for symbols.

In[3]:=
```
?General`Lorentz`*
```

General`Lorentz`

Absorption Dispersion Lorentz

```
Absorption[w,{amp,w0,lam}] generates
 a Absorption  Lorentzian function of w with
 amplitude amp, centre freq w0, and hwhh = lam;

Absorption[w,{w0,lam}] assumes unit amplitude;

Absorption[w,{{_,_,_}...}] generates
 a superposition of such Absorption Lorentzians
```

In[6]:=
```
?? Absorption
```

In[16]:=
```
(Im[#] ^= 0) & /@ {w, Rea, Ima, w0, lam, k}
```

UpSet::write : Tag Re in Im[Re[a]] is Protected. More…

UpSet::write : Tag Im in Im[Im[a]] is Protected. More…

Out[16]=
```
{0, 0, 0, 0, 0, 0}
```

In[12]:=
```
Absorption[w, {Rea, w0, lam}]
```

Out[12]=

$$\frac{\mathrm{lam}\,\mathrm{Rea}}{\mathrm{lam}^2 + (w - w0)^2}$$

In[13]:=
```
Dispersion[w, {Ima, w0, lam}]
```

Out[13]=

$$\frac{\mathrm{Ima}\,(w - w0)}{\mathrm{lam}^2 + (w - w0)^2}$$

In[14]:=
```
ReLor[w_, {a_, w0_, lam_}] =
  (Rea = Re[a]; Ima = Im[a];
   Absorption[w, {Rea, w0, lam}] +
    Dispersion[w, {Ima, w0, lam}])
```

Out[14]=

$$\frac{(w - w0)\,\mathrm{Im}[a]}{\mathrm{lam}^2 + (w - w0)^2} + \frac{\mathrm{lam}\,\mathrm{Re}[a]}{\mathrm{lam}^2 + (w - w0)^2}$$

In[18]:=
```
Sqrt[-(k^2 - (WD/2)^2)];
ReLor[W, { (1 - I*k/R)/2, R, k}] +
 ReLor[W, { (1 + I*k/R)/2, -R, k}]
```

Out[19]=

$$\frac{k\left(\frac{1}{2} - \frac{1}{2} k\,\mathrm{Im}\left[\frac{1}{\sqrt{-k^2+\frac{WD^2}{4}}}\right]\right)}{k^2 + \left(W + \sqrt{-k^2 + \frac{WD^2}{4}}\right)^2} + \frac{k\left(\frac{1}{2} + \frac{1}{2} k\,\mathrm{Im}\left[\frac{1}{\sqrt{-k^2+\frac{WD^2}{4}}}\right]\right)}{k^2 + \left(W - \sqrt{-k^2 + \frac{WD^2}{4}}\right)^2} -$$

$$\frac{k\left(W - \sqrt{-k^2 + \frac{WD^2}{4}}\right)\mathrm{Re}\left[\frac{1}{\sqrt{-k^2+\frac{WD^2}{4}}}\right]}{2\left(k^2 + \left(W - \sqrt{-k^2 + \frac{WD^2}{4}}\right)^2\right)} +$$

$$\frac{k\left(W + \sqrt{-k^2 + \frac{WD^2}{4}}\right)\mathrm{Re}\left[\frac{1}{\sqrt{-k^2+\frac{WD^2}{4}}}\right]}{2\left(k^2 + \left(W + \sqrt{-k^2 + \frac{WD^2}{4}}\right)^2\right)}$$

In[20]:=
```
% /. {Im[_] → 0, Re[arg_] → arg}
```

General::spell1 : Possible spelling error: new symbol name "arg" is similar to existing symbol "Arg". More…

Out[20]=

$$\frac{k}{2\left(k^2 + \left(W - \sqrt{-k^2 + \frac{WD^2}{4}}\right)^2\right)} - \frac{k\left(W - \sqrt{-k^2 + \frac{WD^2}{4}}\right)}{2\sqrt{-k^2 + \frac{WD^2}{4}}\left(k^2 + \left(W - \sqrt{-k^2 + \frac{WD^2}{4}}\right)^2\right)} +$$

$$\frac{k}{2\left(k^2 + \left(W + \sqrt{-k^2 + \frac{WD^2}{4}}\right)^2\right)} + \frac{k\left(W + \sqrt{-k^2 + \frac{WD^2}{4}}\right)}{2\sqrt{-k^2 + \frac{WD^2}{4}}\left(k^2 + \left(W + \sqrt{-k^2 + \frac{WD^2}{4}}\right)^2\right)}$$

In[21]:=
```
% // ExpandAll
```

Out[21]=

$$\frac{k}{2W^2 + \frac{WD^2}{2} - 4W\sqrt{-k^2 + \frac{WD^2}{4}}} + \frac{k}{2W^2 + \frac{WD^2}{2} + 4W\sqrt{-k^2 + \frac{WD^2}{4}}} -$$

$$\frac{k\,W}{4k^2 W - W\,WD^2 + 2W^2\sqrt{-k^2 + \frac{WD^2}{4}} + \frac{1}{2}WD^2\sqrt{-k^2 + \frac{WD^2}{4}}} +$$

$$\frac{k\sqrt{-k^2 + \frac{WD^2}{4}}}{4k^2 W - W\,WD^2 + 2W^2\sqrt{-k^2 + \frac{WD^2}{4}} + \frac{1}{2}WD^2\sqrt{-k^2 + \frac{WD^2}{4}}} +$$

$$\frac{k\,W}{-4k^2 W + W\,WD^2 + 2W^2\sqrt{-k^2 + \frac{WD^2}{4}} + \frac{1}{2}WD^2\sqrt{-k^2 + \frac{WD^2}{4}}} +$$

$$\frac{k\sqrt{-k^2 + \frac{WD^2}{4}}}{-4k^2 W + W\,WD^2 + 2W^2\sqrt{-k^2 + \frac{WD^2}{4}} + \frac{1}{2}WD^2\sqrt{-k^2 + \frac{WD^2}{4}}}$$

In[22]:=
```
% // Together
```

Out[22]=

$$(8\,(256k^5W^2WD^2 + 64k^3W^4WD^2 - 96k^3W^2WD^4 - 16kW^4WD^4 + 4k^3WD^6 + 8kW^2WD^6 - kWD^8)) \Big/ \left(\left(-4W^2 - WD^2 + 4W\sqrt{-4k^2 + WD^2}\right)\left(4W^2 + WD^2 + 4W\sqrt{-4k^2 + WD^2}\right)\left(16k^2W - 4W\,WD^2 + 4W^2\sqrt{-4k^2 + WD^2} + WD^2\sqrt{-4k^2 + WD^2}\right)\left(-16k^2W + 4W\,WD^2 + 4W^2\sqrt{-4k^2 + WD^2} + WD^2\sqrt{-4k^2 + WD^2}\right)\right)$$

In[23]:=
```
% // ExpandAll
```

Out[23]=

$$(2048k^5W^2WD^2) / (16384k^6W^4 + 8192k^4W^6 + 1024k^2W^8 - 8192k^4W^4WD^2 - 3072k^2W^6WD^2 - 256W^8WD^2 + 512k^4W^2WD^4 + 1408k^2W^4WD^4 + 256W^6WD^4 - 192k^2W^2WD^6 - 96W^4WD^6 + 4k^2WD^8 + 16W^2WD^8 - WD^{10}) +$$

$$(512k^3W^4WD^2) / (16384k^6W^4 + 8192k^4W^6 + 1024k^2W^8 - 8192k^4W^4WD^2 - 3072k^2W^6WD^2 - 256W^8WD^2 + 512k^4W^2WD^4 + 1408k^2W^4WD^4 + 256W^6WD^4 - 192k^2W^2WD^6 - 96W^4WD^6 + 4k^2WD^8 + 16W^2WD^8 - WD^{10}) -$$

$$(768k^3W^2WD^4) / (16384k^6W^4 + 8192k^4W^6 + 1024k^2W^8 - 8192k^4W^4WD^2 - 3072k^2W^6WD^2 - 256W^8WD^2 + 512k^4W^2WD^4 + 1408k^2W^4WD^4 + 256W^6WD^4 - 192k^2W^2WD^6 - 96W^4WD^6 + 4k^2WD^8 + 16W^2WD^8 - WD^{10}) -$$

$$(128kW^4WD^4) / (16384k^6W^4 + 8192k^4W^6 + 1024k^2W^8 - 8192k^4W^4WD^2 - 3072k^2W^6WD^2 - 256W^8WD^2 + 512k^4W^2WD^4 + 1408k^2W^4WD^4 + 256W^6WD^4 - 192k^2W^2WD^6 - 96W^4WD^6 + 4k^2WD^8 + 16W^2WD^8 - WD^{10}) +$$

$$(32k^3WD^6) / (16384k^6W^4 + 8192k^4W^6 + 1024k^2W^8 - 8192k^4W^4WD^2 - 3072k^2W^6WD^2 - 256W^8WD^2 + 512k^4W^2WD^4 + 1408k^2W^4WD^4 + 256W^6WD^4 - 192k^2W^2WD^6 - 96W^4WD^6 + 4k^2WD^8 + 16W^2WD^8 - WD^{10}) +$$

$$(64kW^2WD^6) / (16384k^6W^4 + 8192k^4W^6 + 1024k^2W^8 - 8192k^4W^4WD^2 - 3072k^2W^6WD^2 - 256W^8WD^2 + 512k^4W^2WD^4 + 1408k^2W^4WD^4 + 256W^6WD^4 - 192k^2W^2WD^6 - 96W^4WD^6 + 4k^2WD^8 + 16W^2WD^8 - WD^{10}) -$$

$$(8kWD^8) / (16384k^6W^4 + 8192k^4W^6 + 1024k^2W^8 - 8192k^4W^4WD^2 - 3072k^2W^6WD^2 - 256W^8WD^2 + 512k^4W^2WD^4 + 1408k^2W^4WD^4 + 256W^6WD^4 - 192k^2W^2WD^6 - 96W^4WD^6 + 4k^2WD^8 + 16W^2WD^8 - WD^{10})$$

In[24]:=
```
% // Together
```

Out[24]=

$$\frac{8k\,WD^2}{64k^2W^2 + 16W^4 - 8W^2WD^2 + WD^4}$$

In[25]:=
```
% // Simplify
```

Out[25]=

$$\frac{8k\,WD^2}{64k^2W^2 + (-4W^2 + WD^2)^2}$$