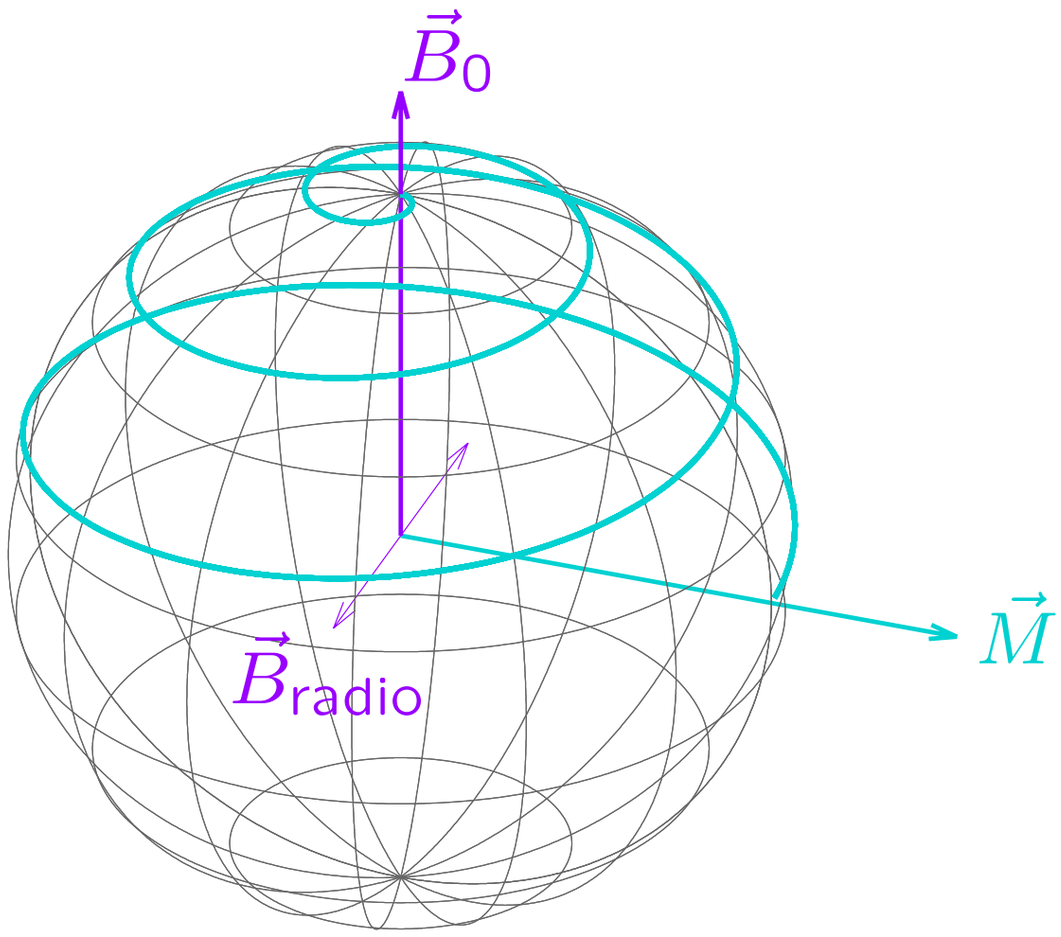
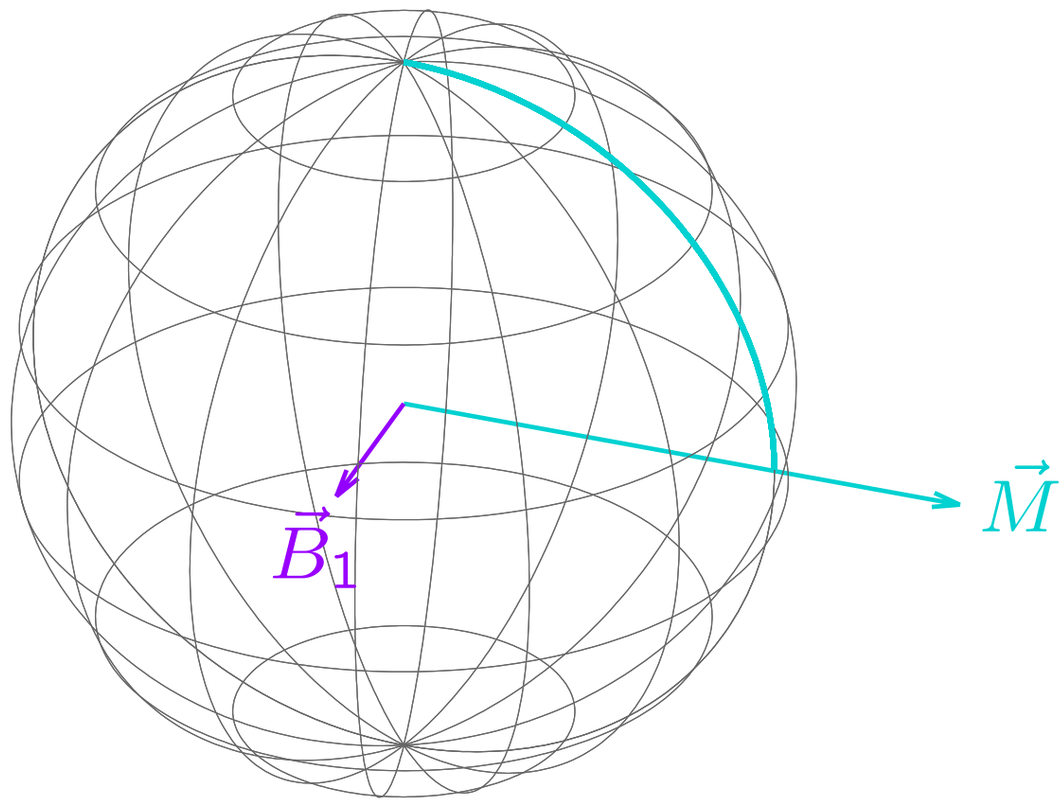
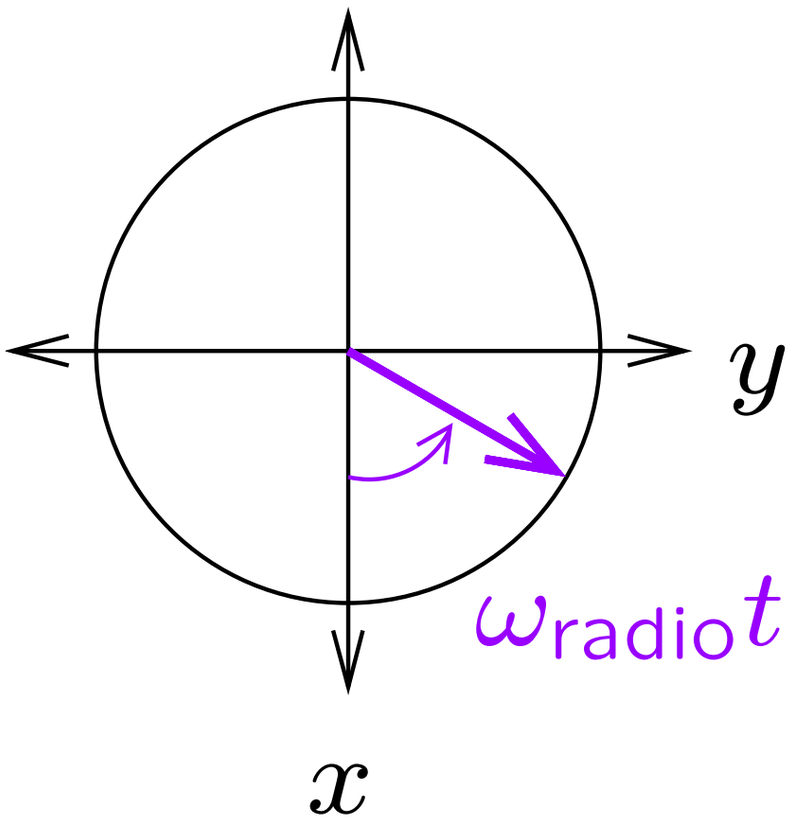
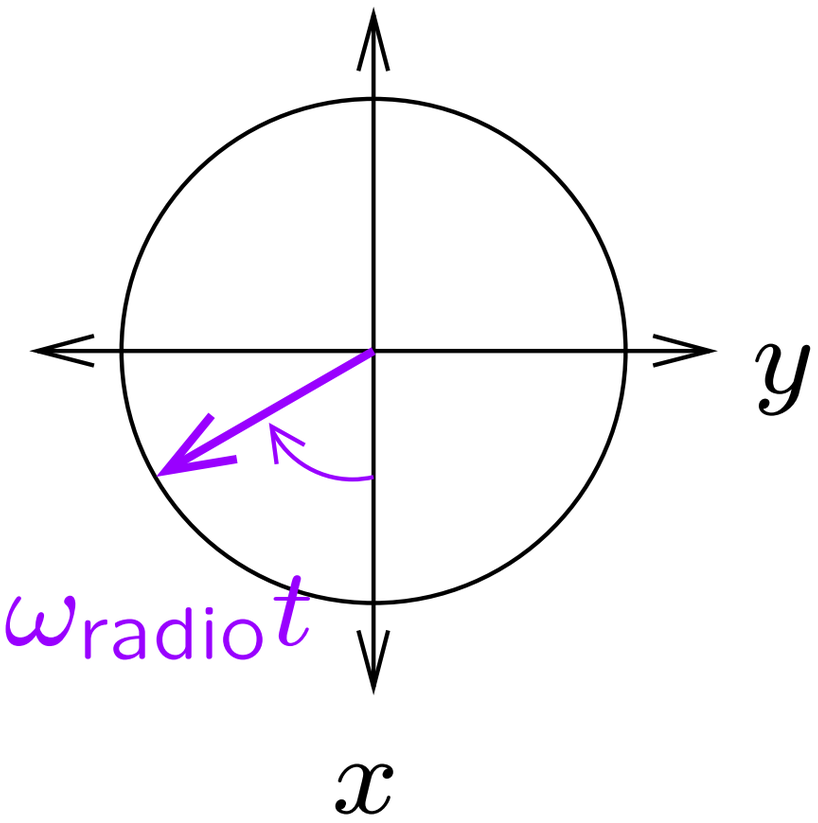
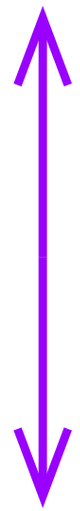
LECTURE 2

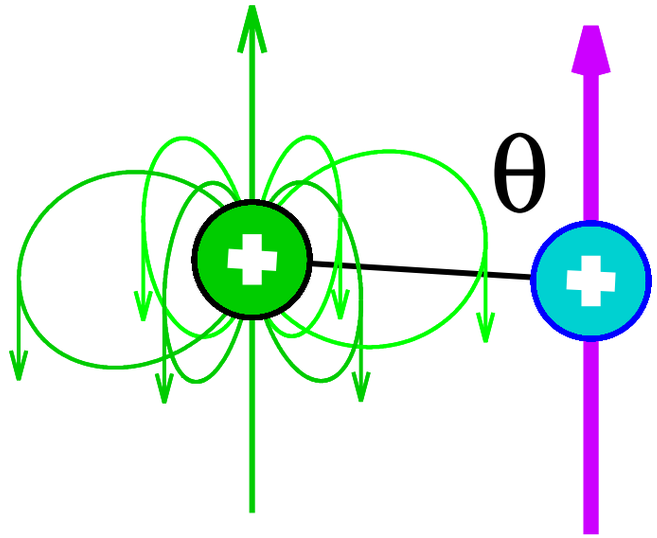

$\vec{B}_0$
$\vec{M}$
$\vec{B}_{\text{radio}}$


$\vec{M}$
$\vec{B}_1$


y
$\omega_{\text{radio}}t$
x


y
$-\omega_{\text{radio}}t$
x

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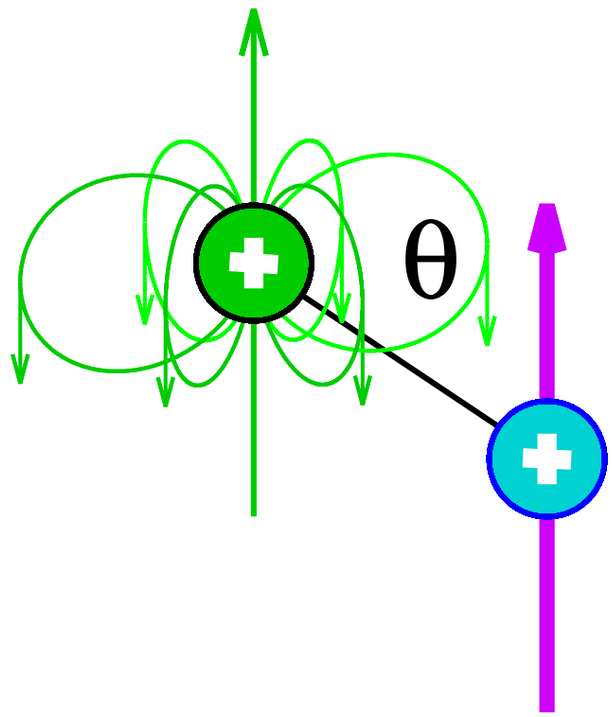
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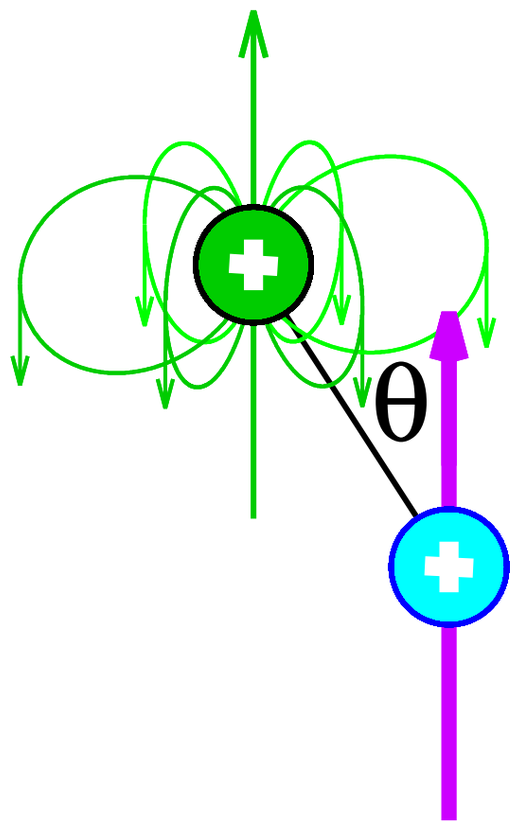
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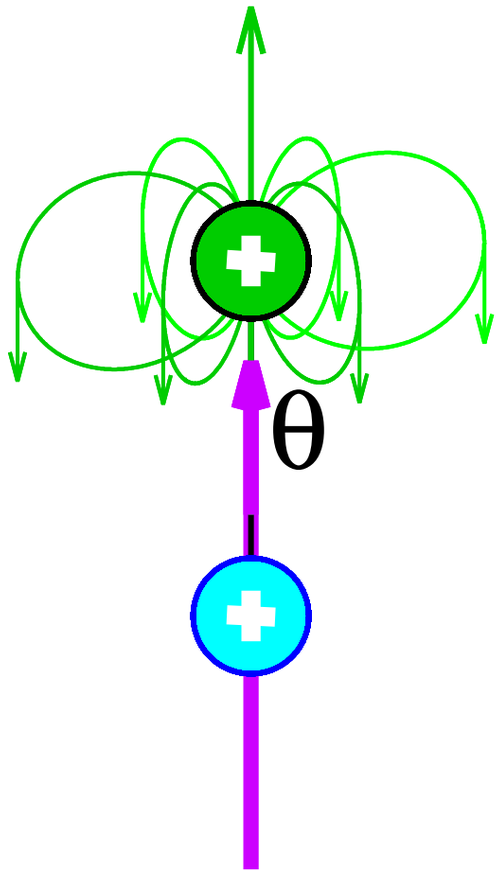
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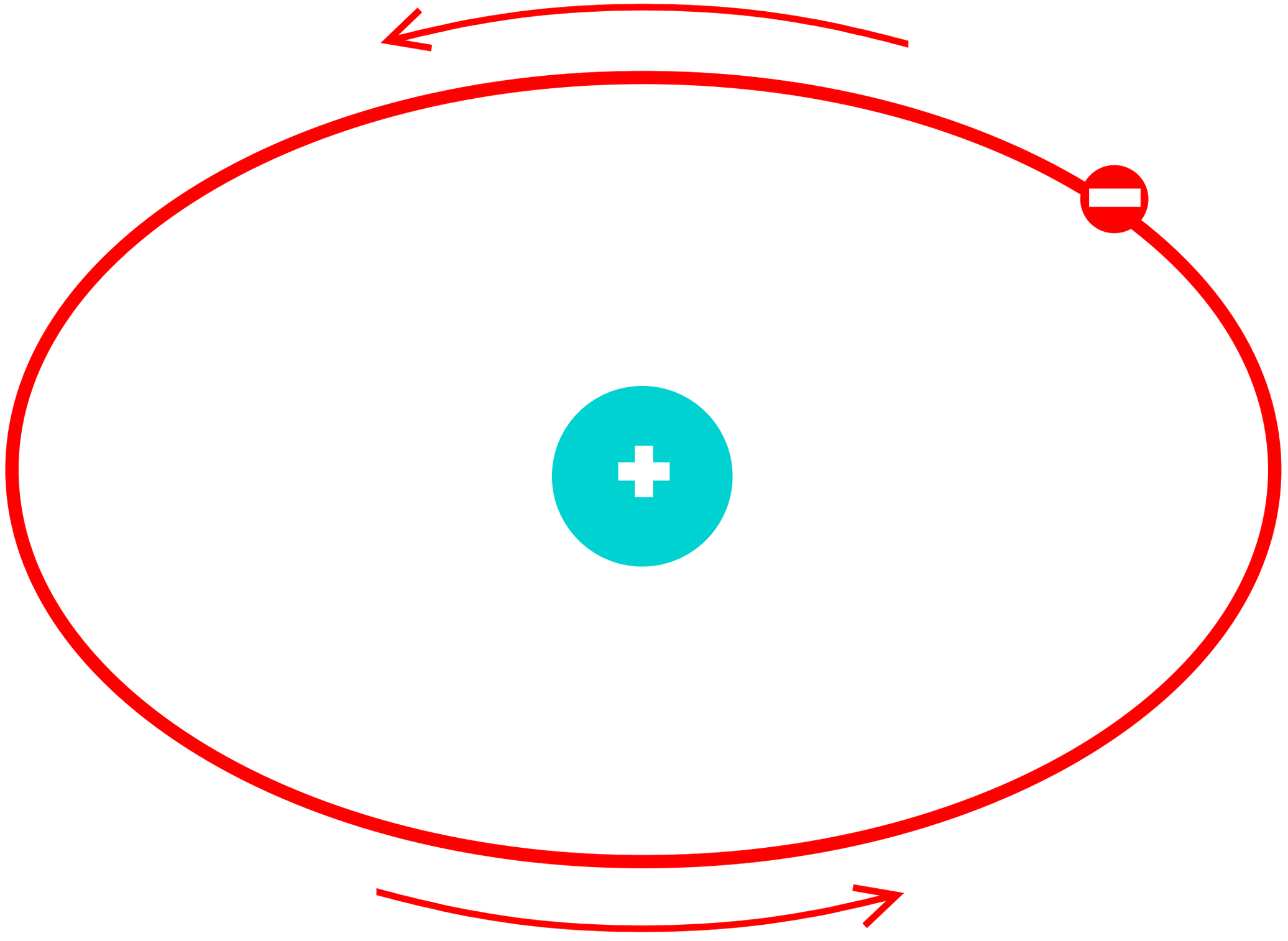

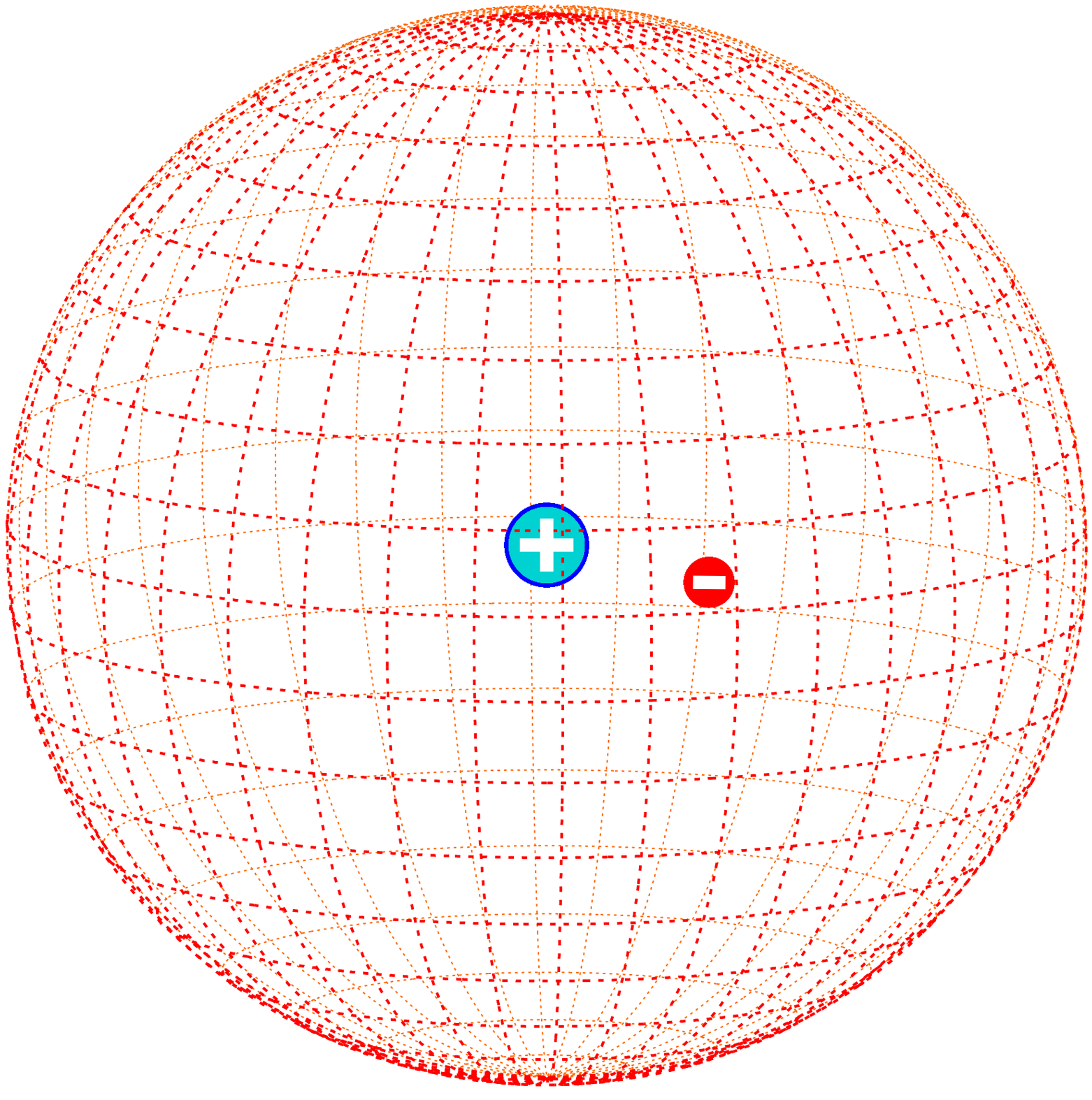

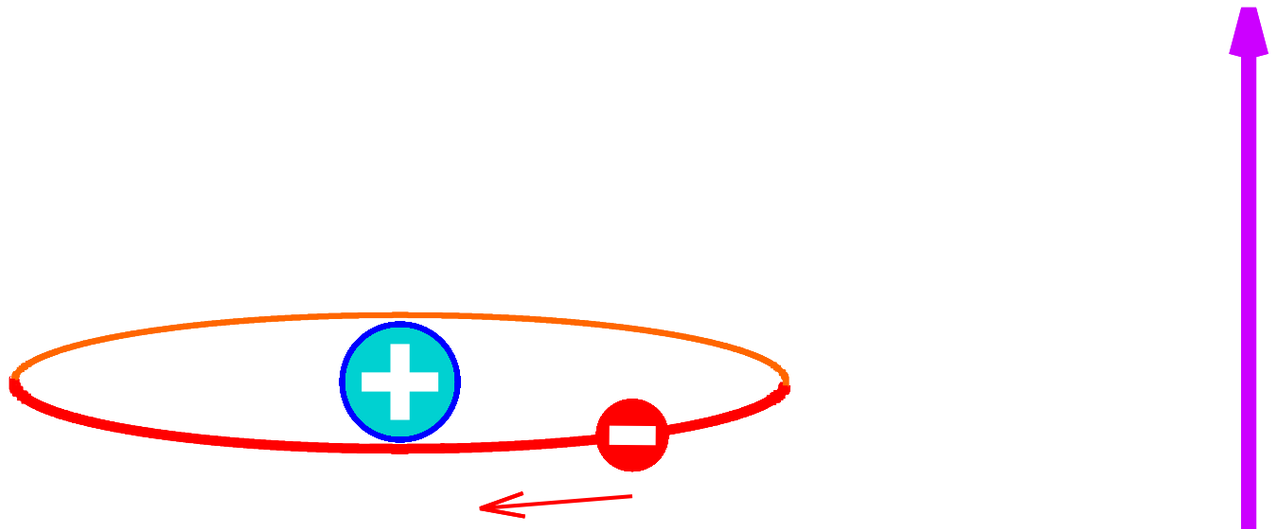

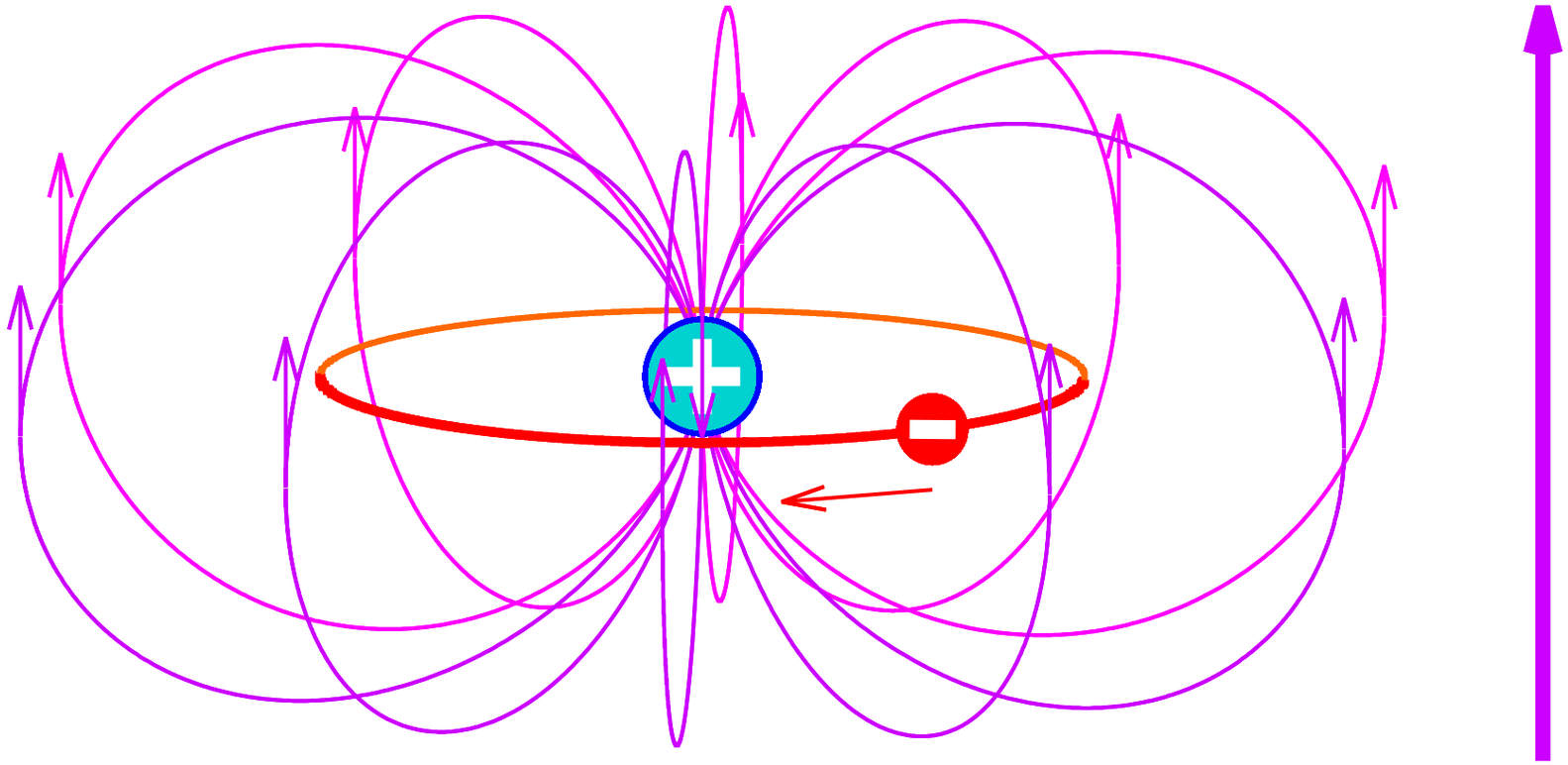

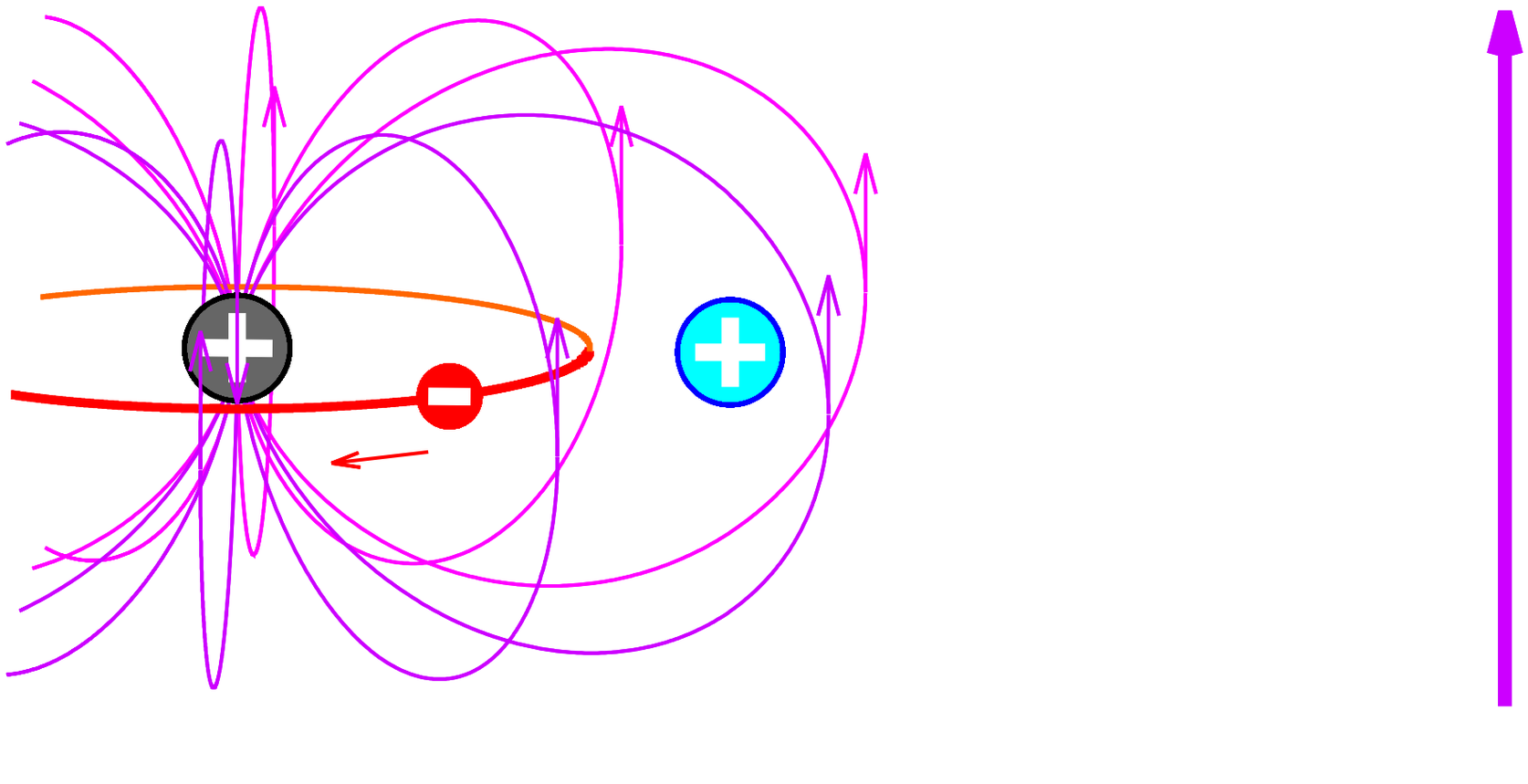

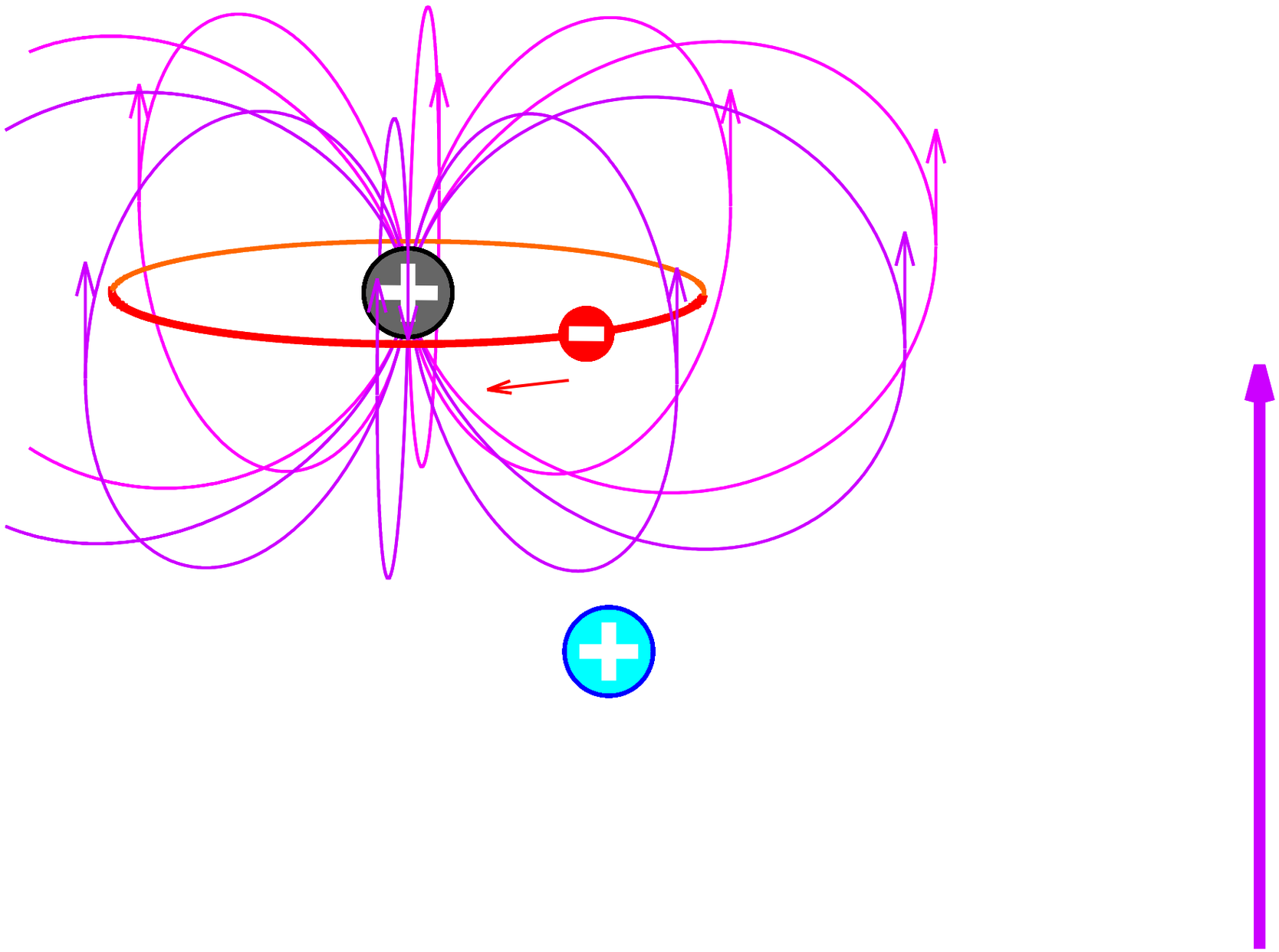

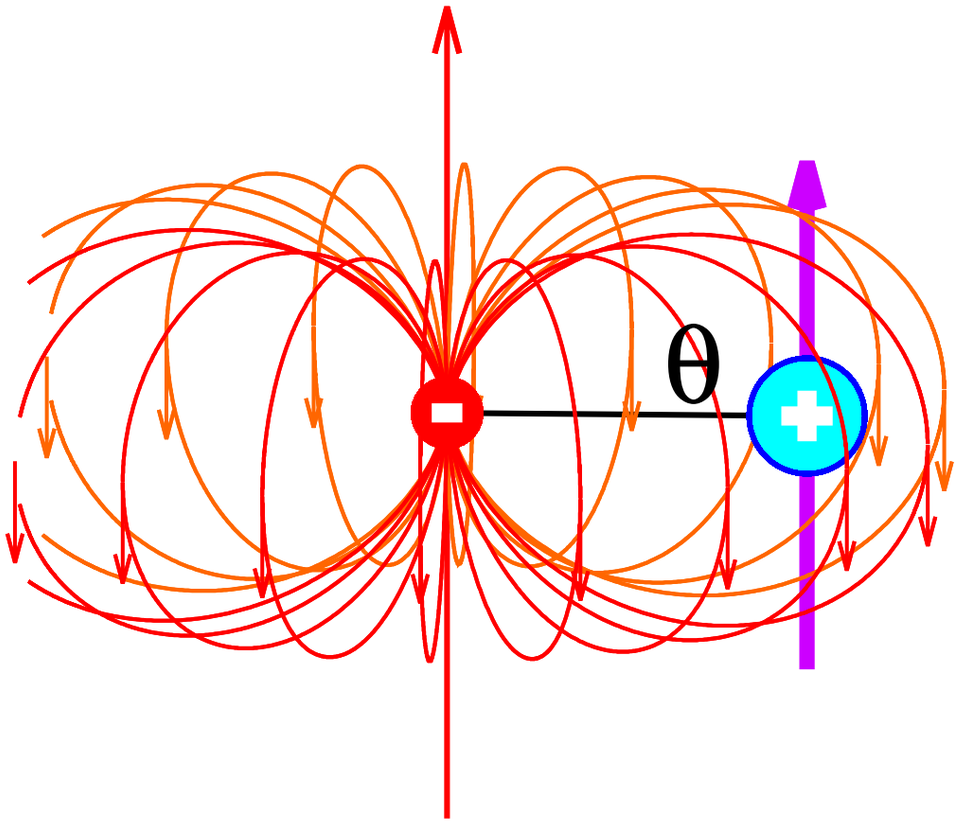
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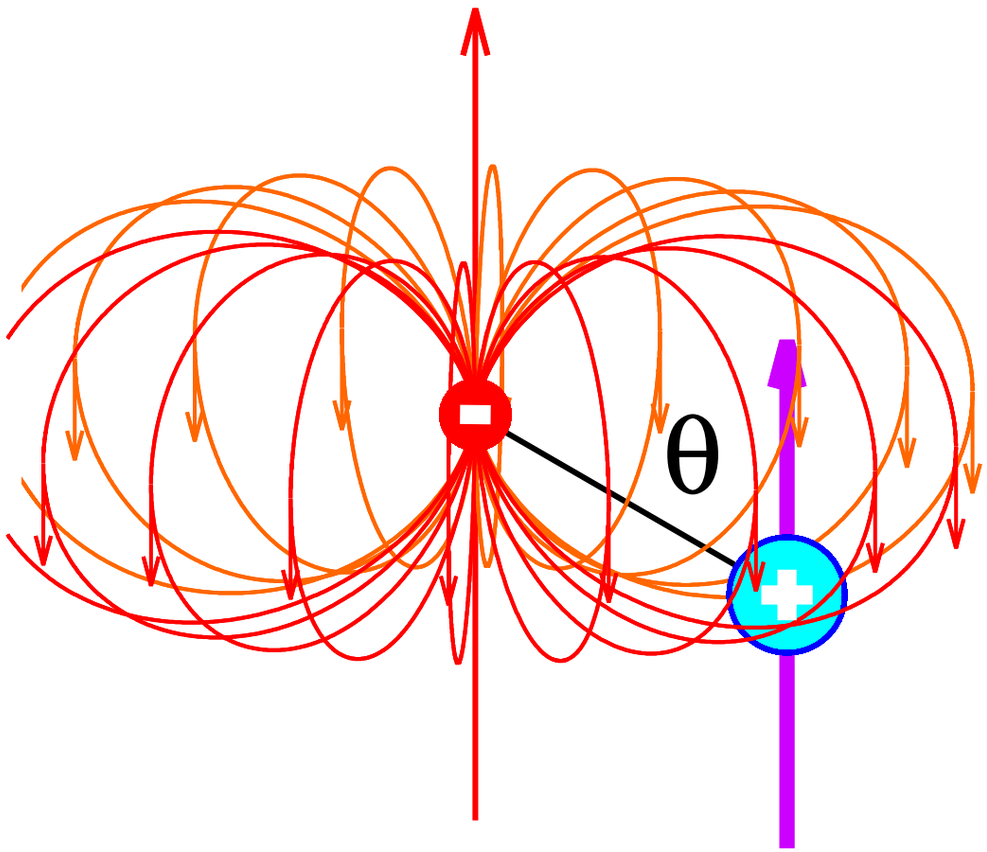
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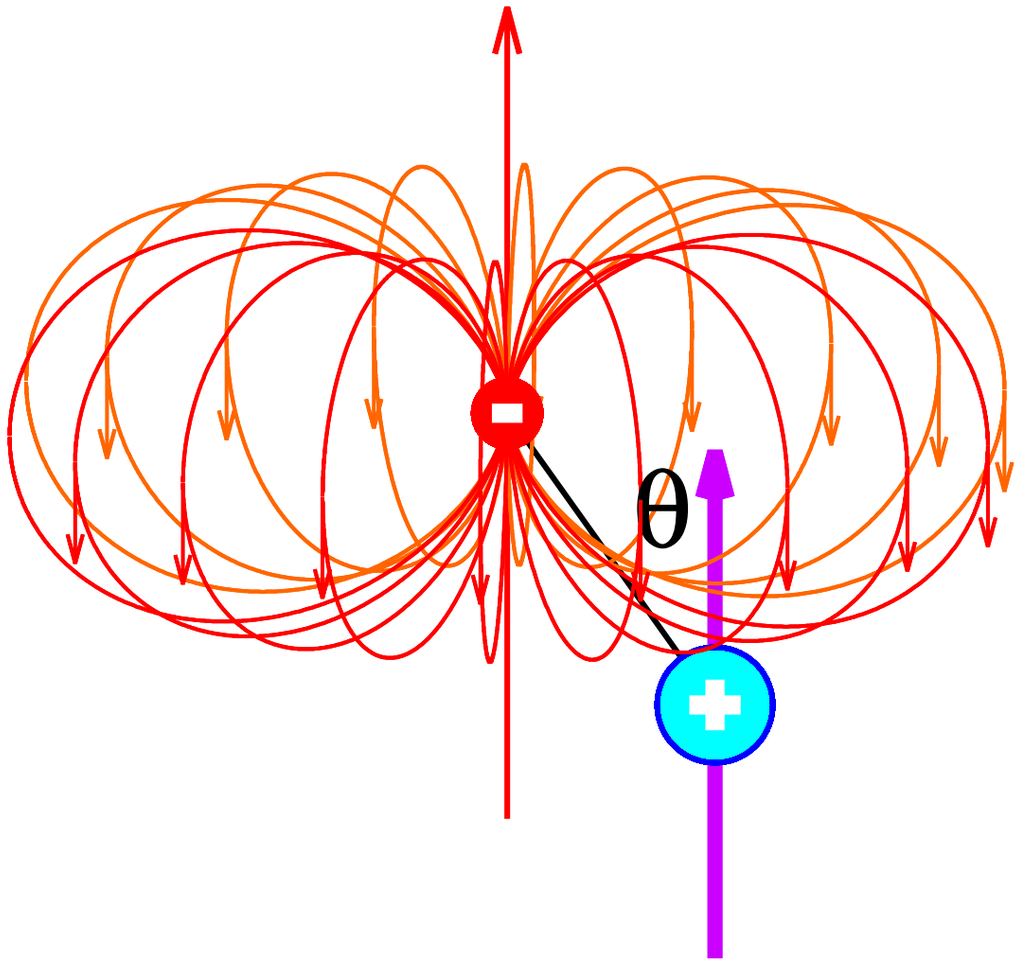
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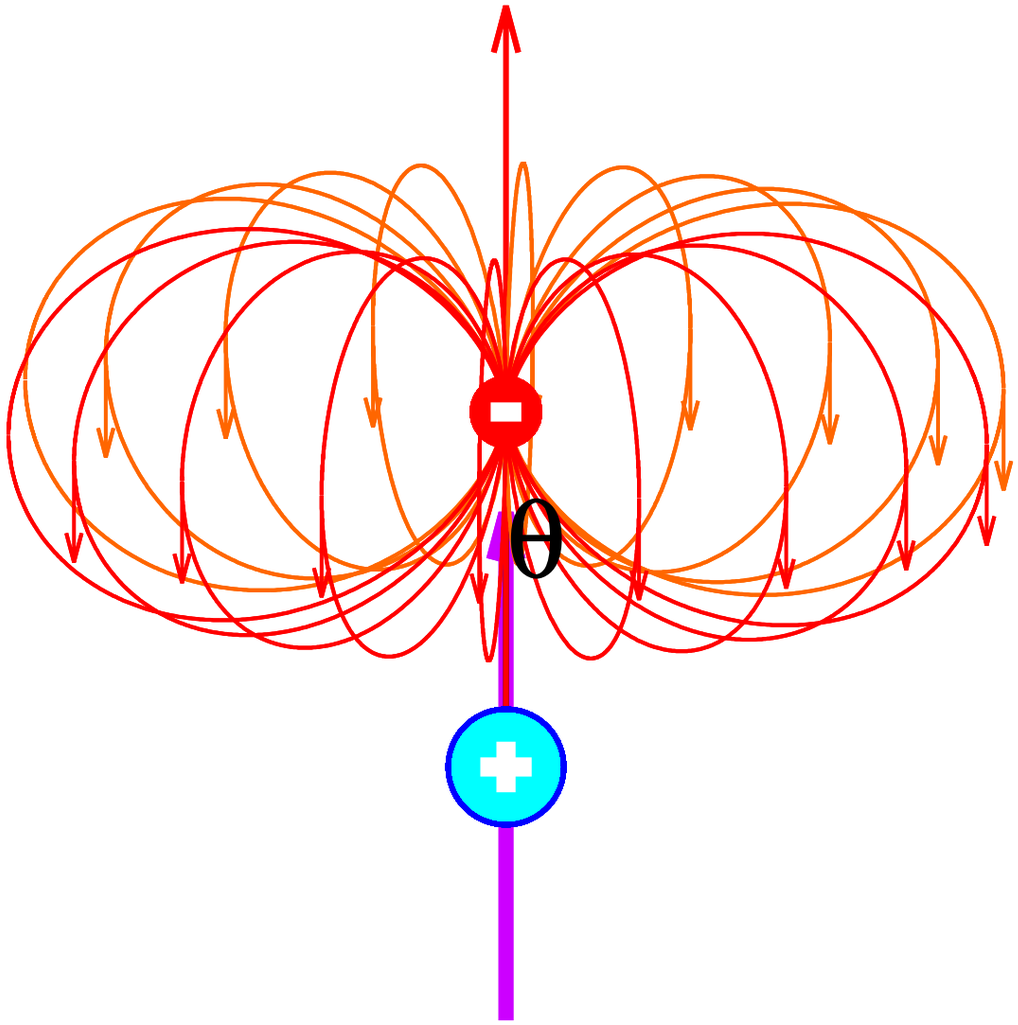
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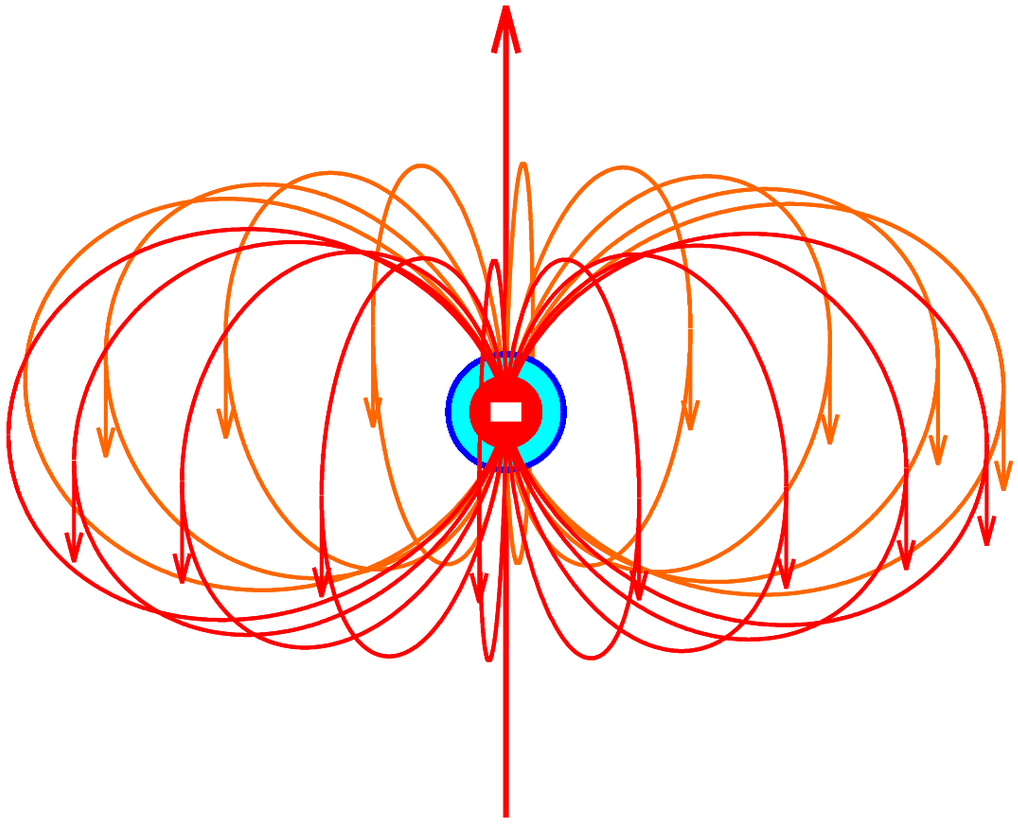
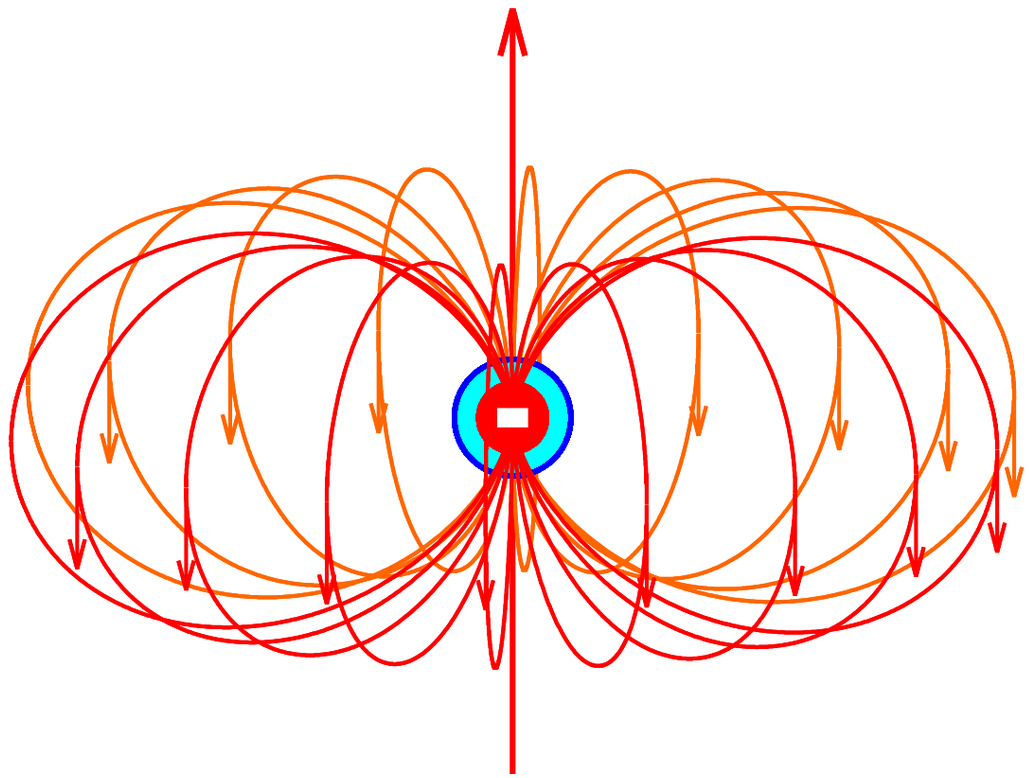
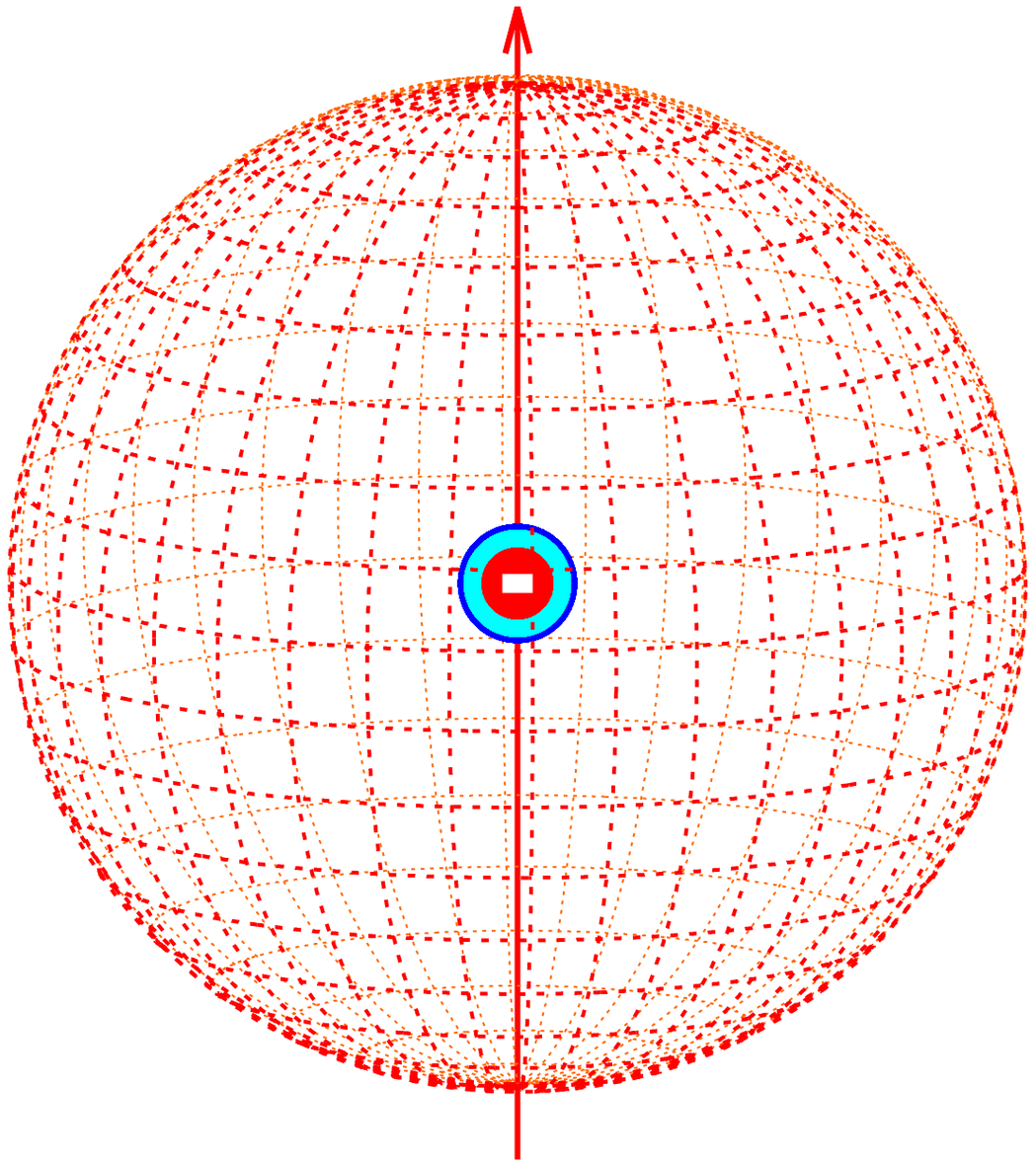
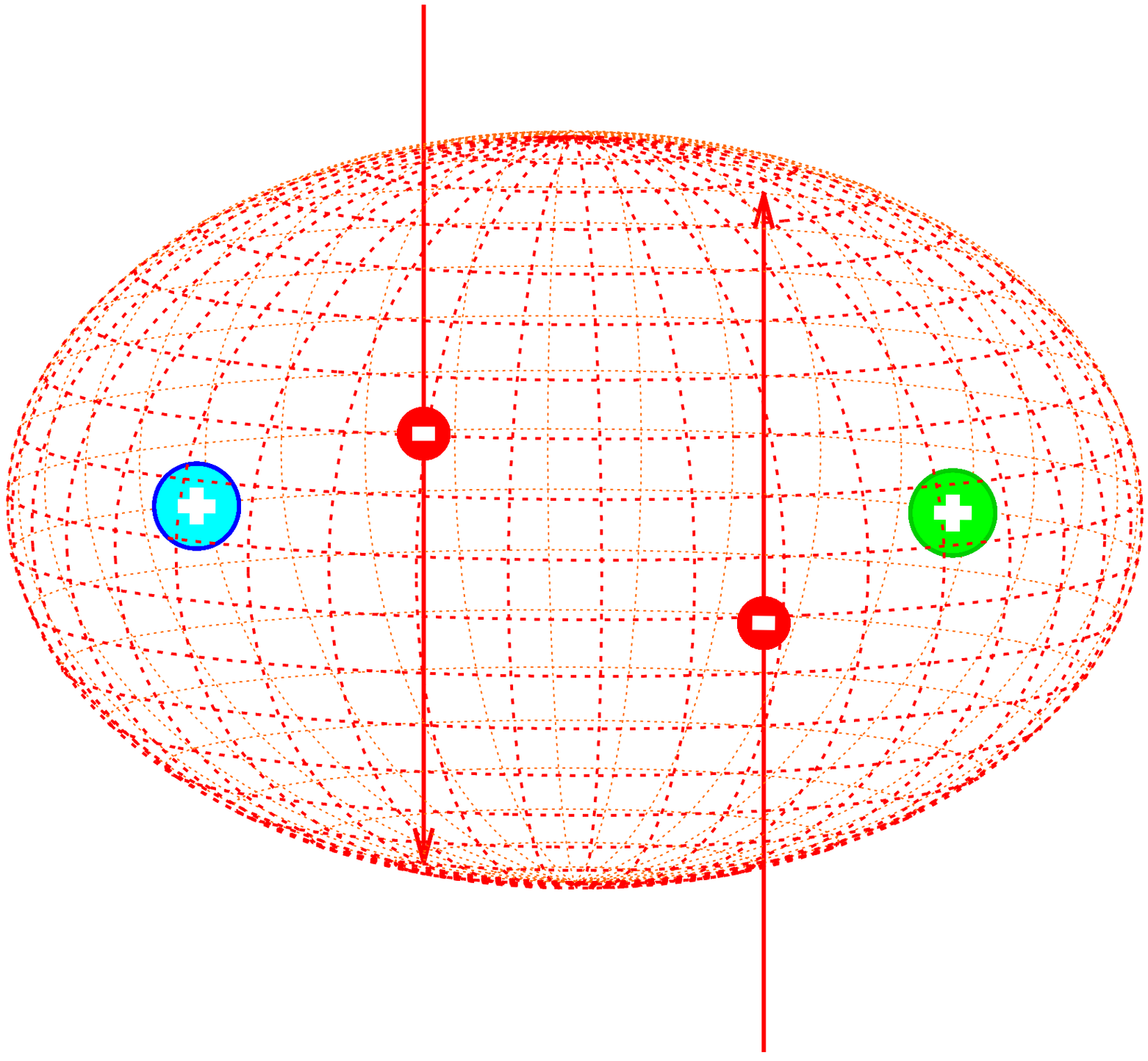
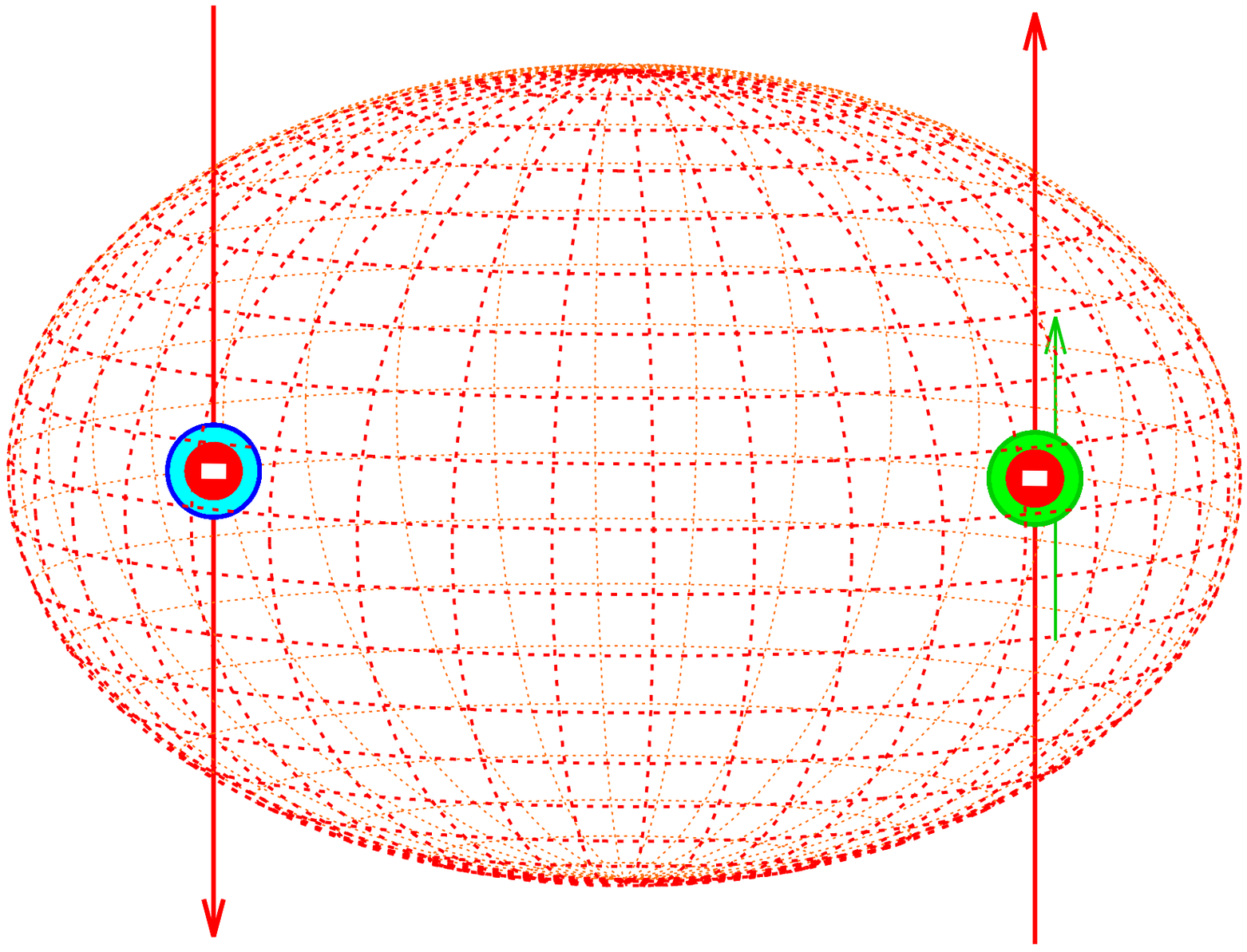


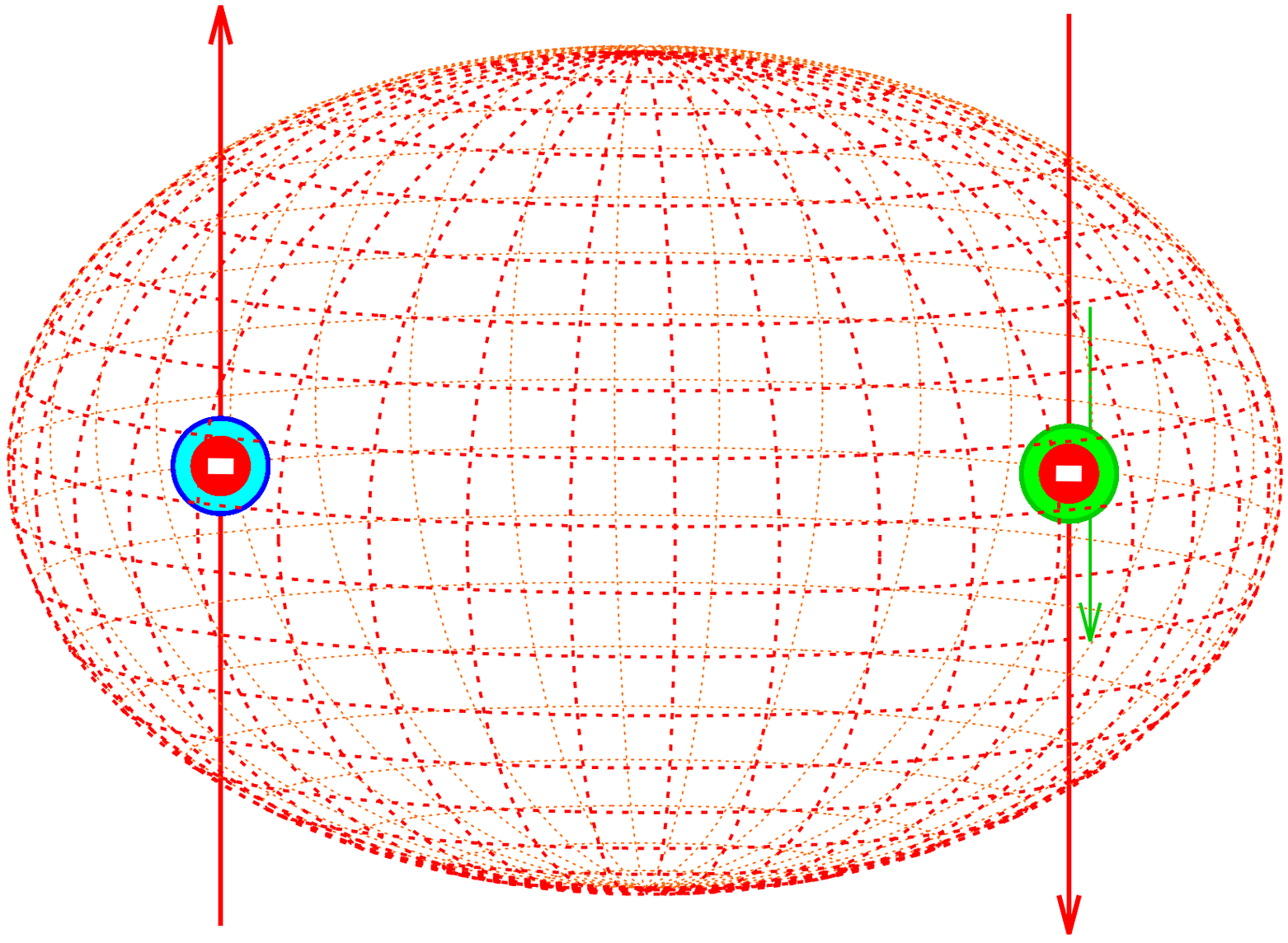
$$E = -\vec{\mu}_{\text{electron}} \cdot \vec{\mu}_{\text{nucleus}} \cdot P(\text{electron at nucleus})$$

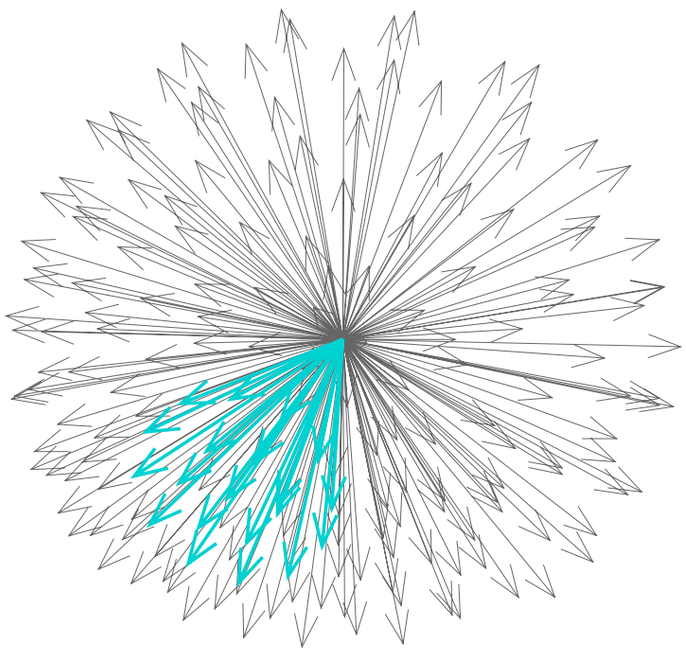


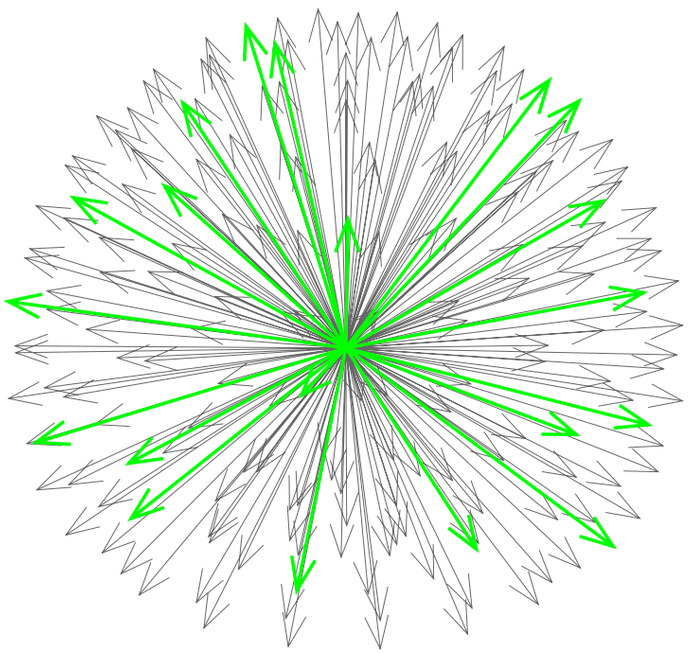


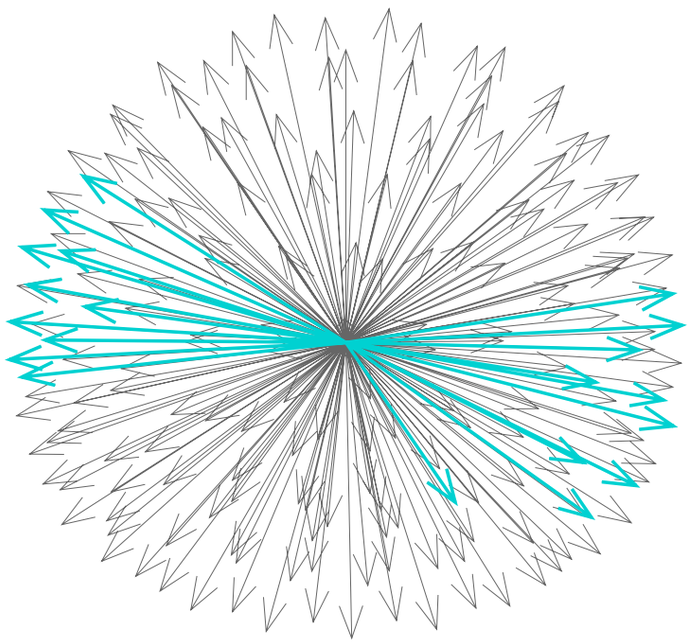


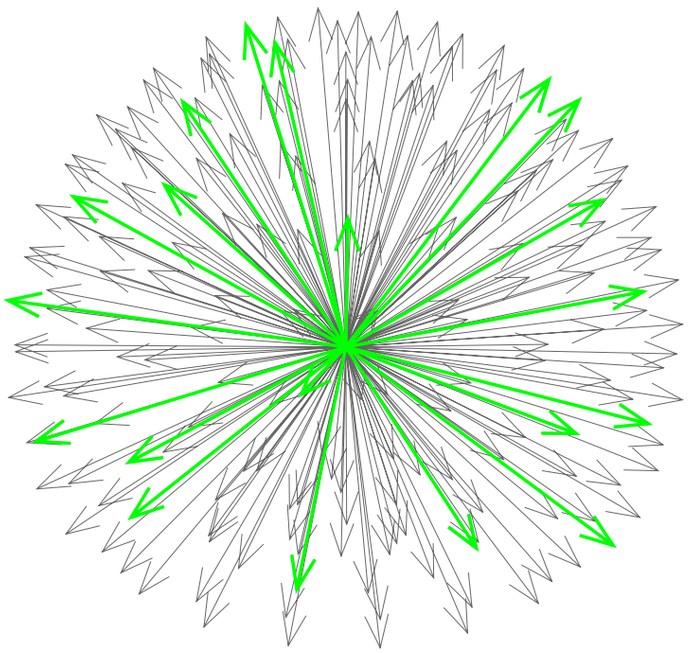


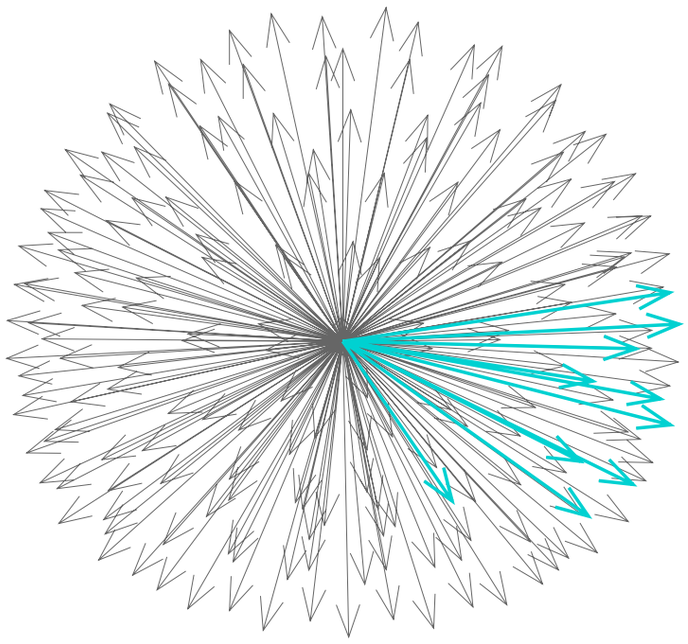


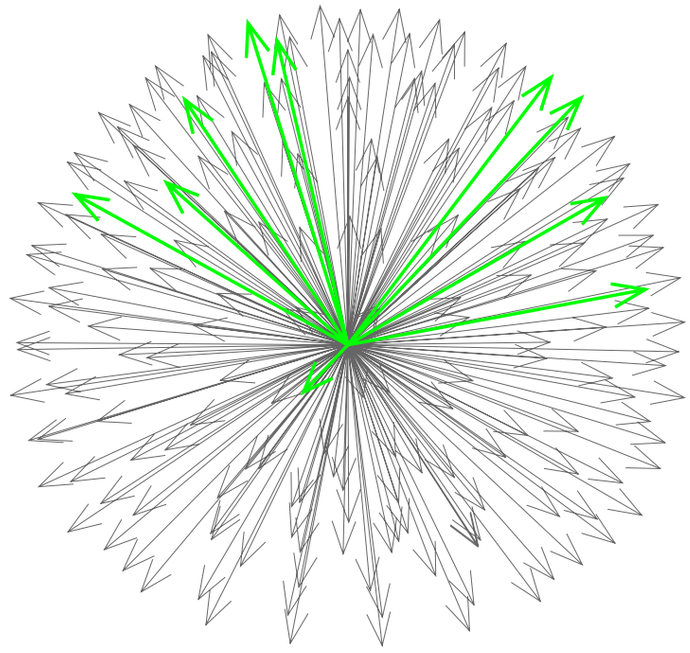


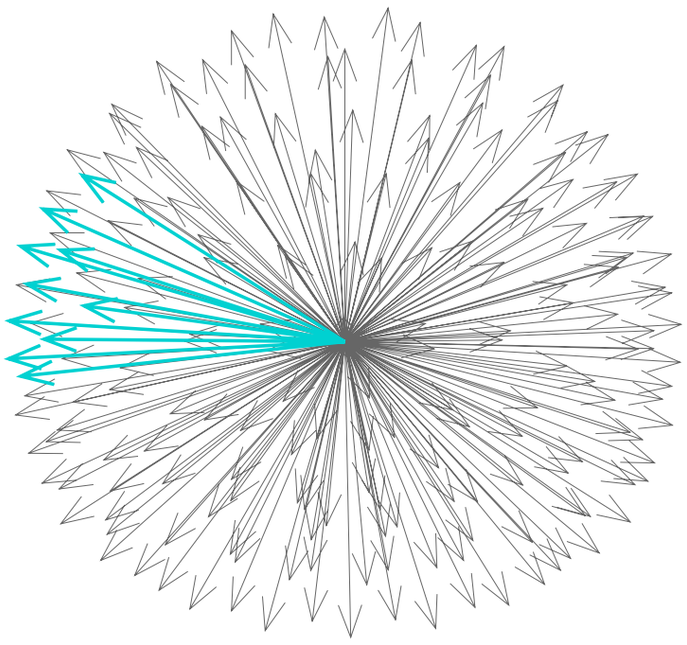


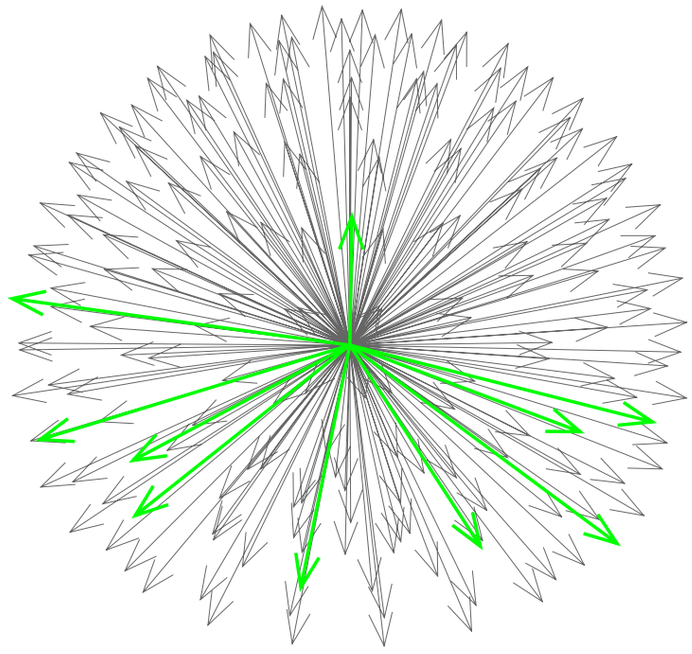


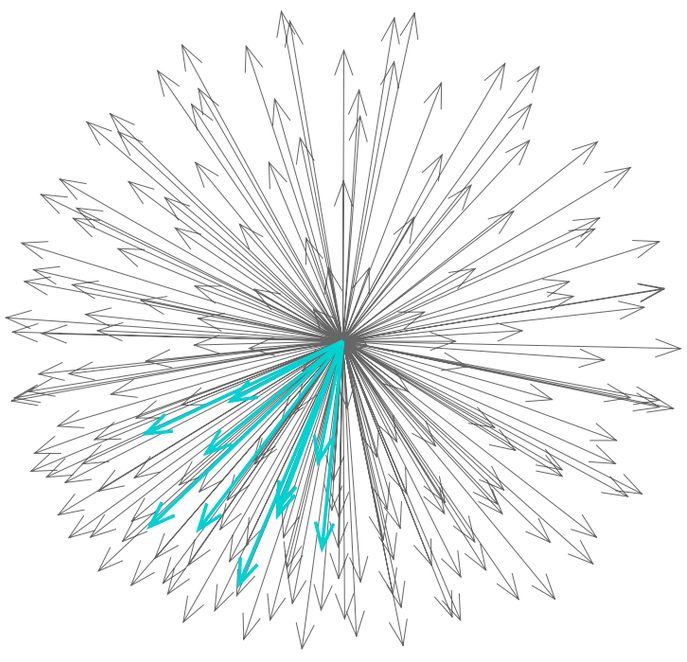


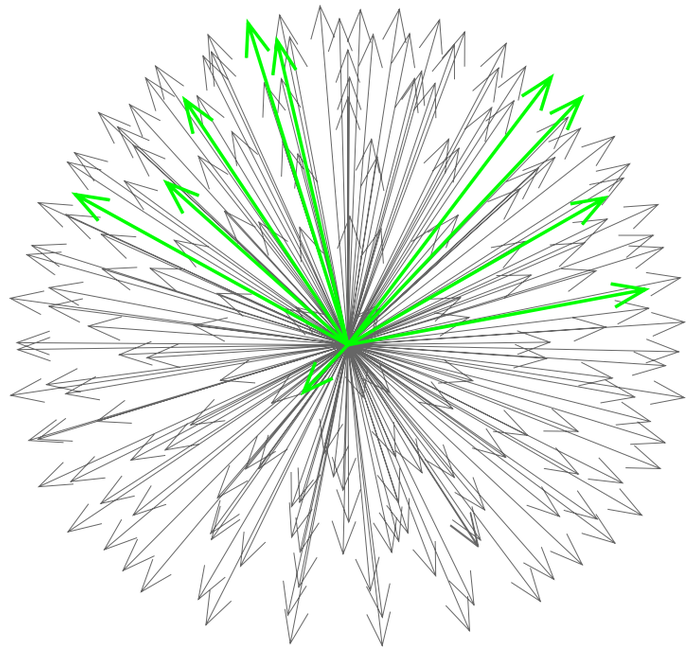


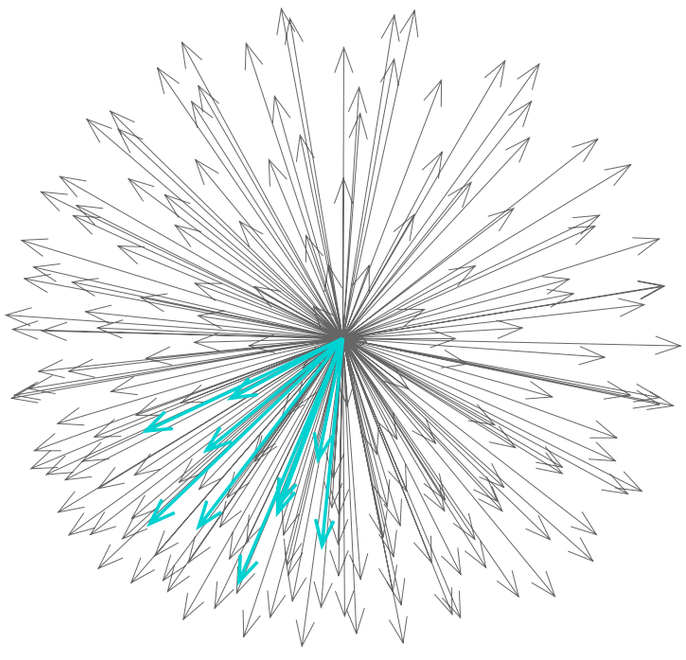


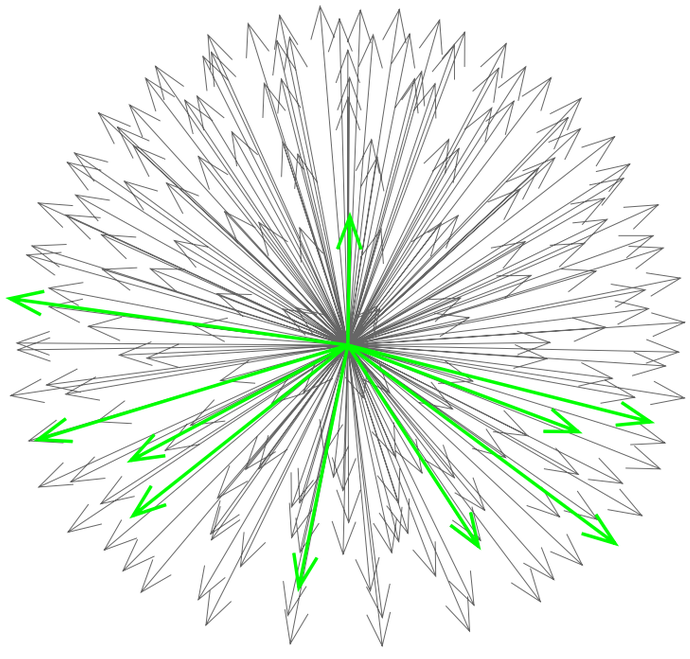


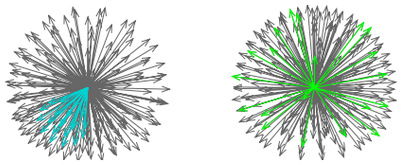
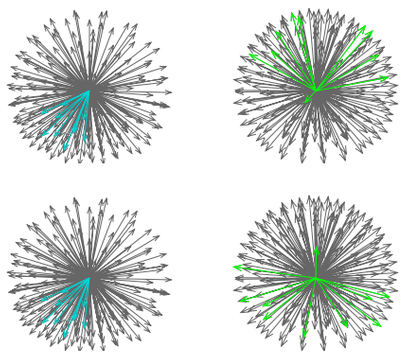
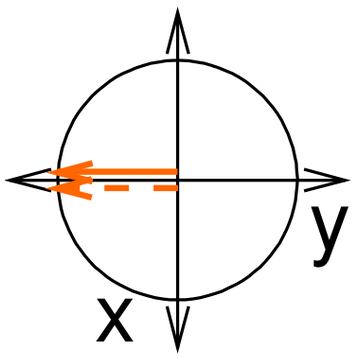
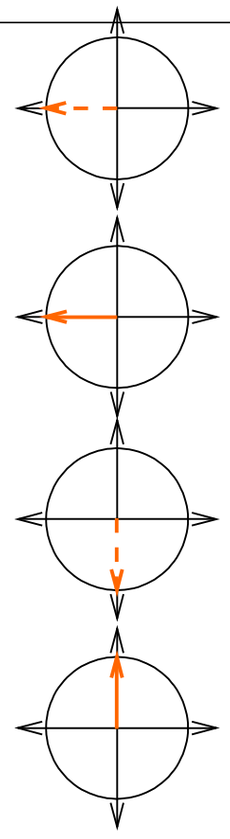
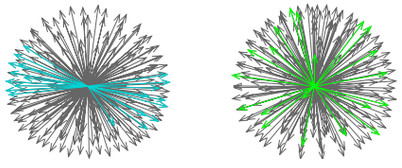
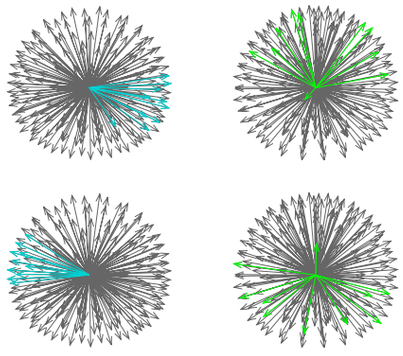
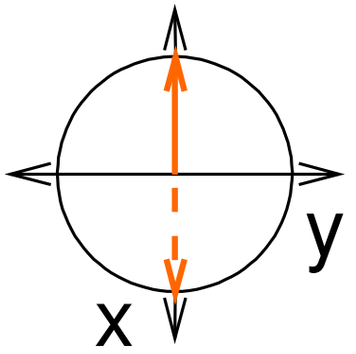






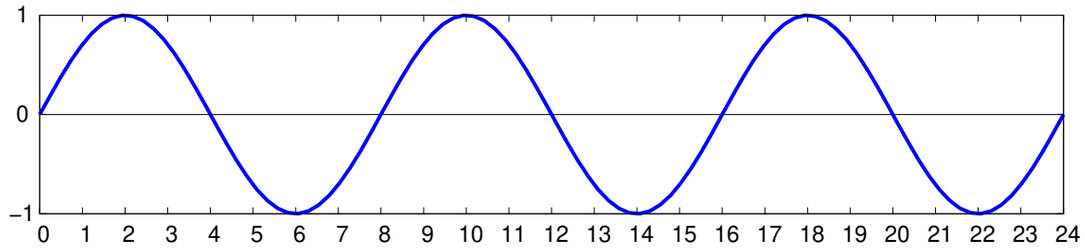




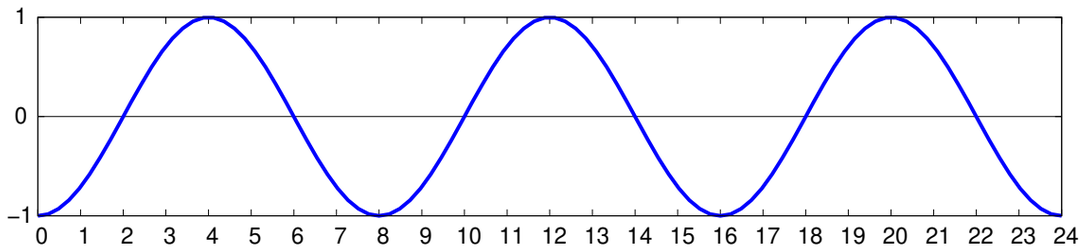
Coherence	depicted as distributions molecules with $\vec{\mu}$ of ^{1}H closest to $-y$ selected	decomposed distributions based on $\vec{\mu}$ of ^{13}C/^{15}N being closer to $+z$ vs. to $-z$ in the selected molecules	depicted as arrows	decomposed arrows
In-phase				
Anti-phase				

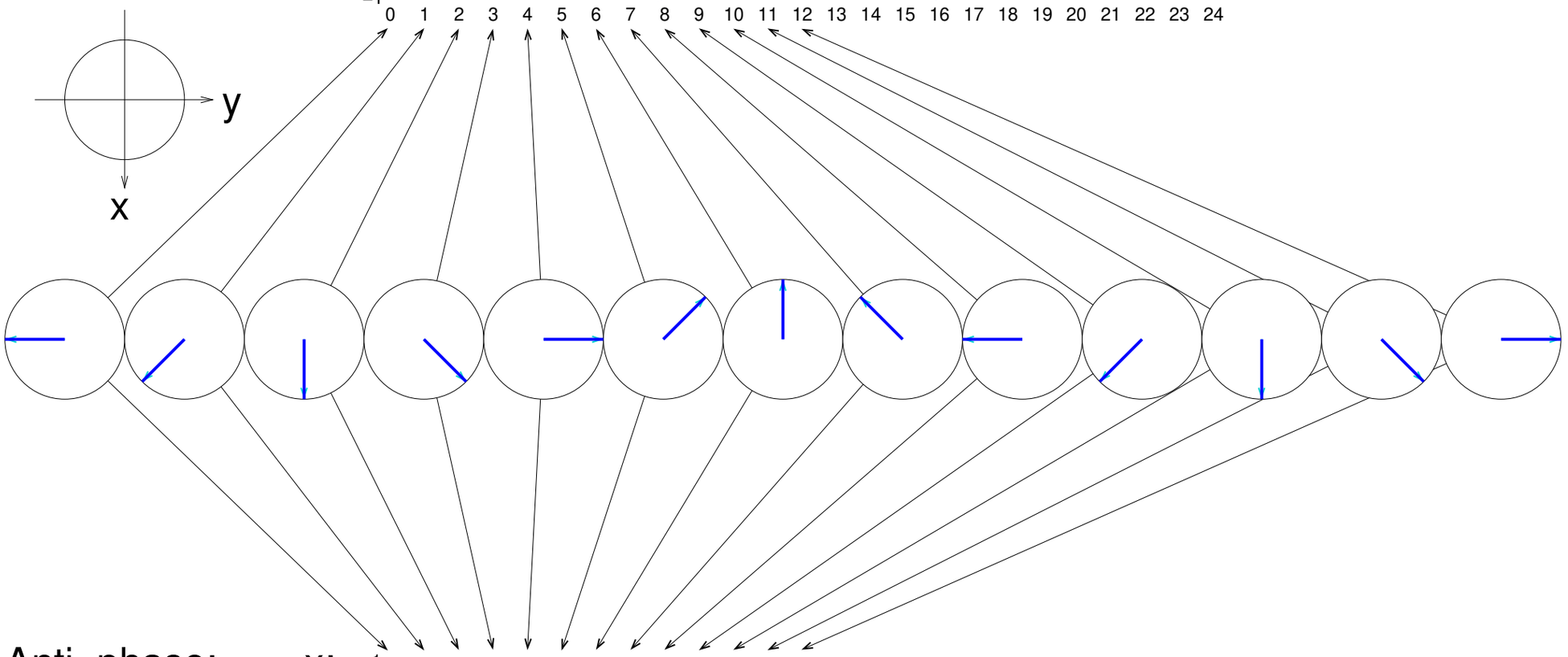
In–phase:

x:



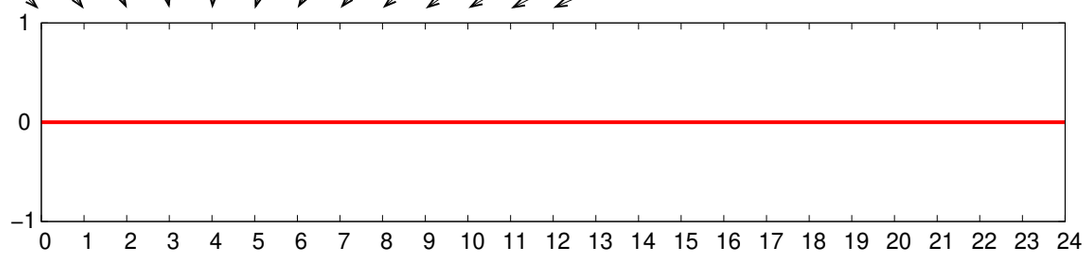
y:



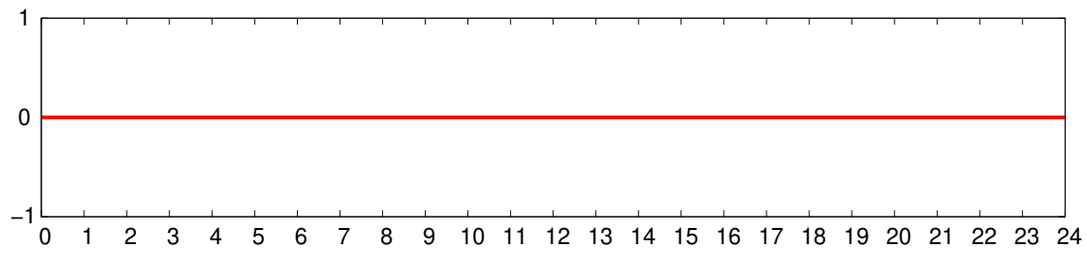


Anti–phase:

x:

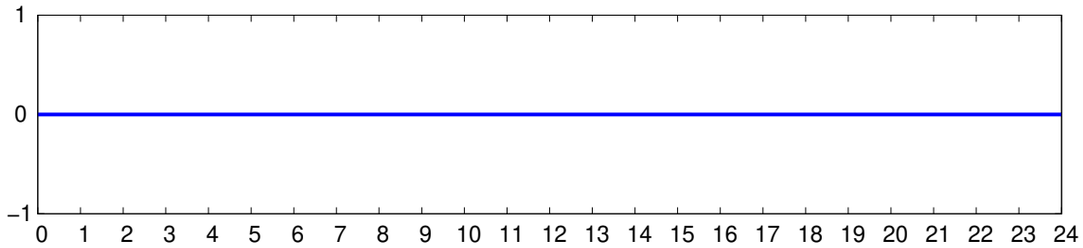


y:

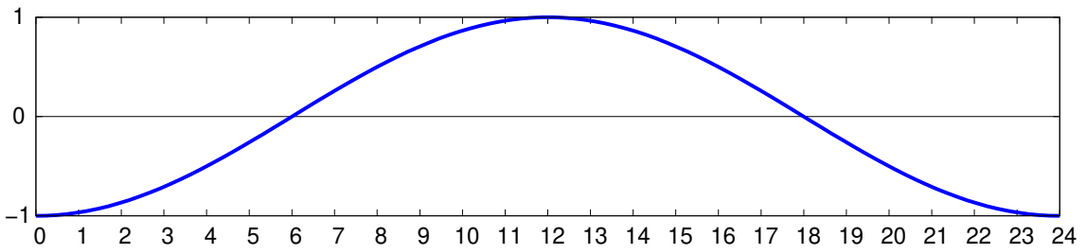


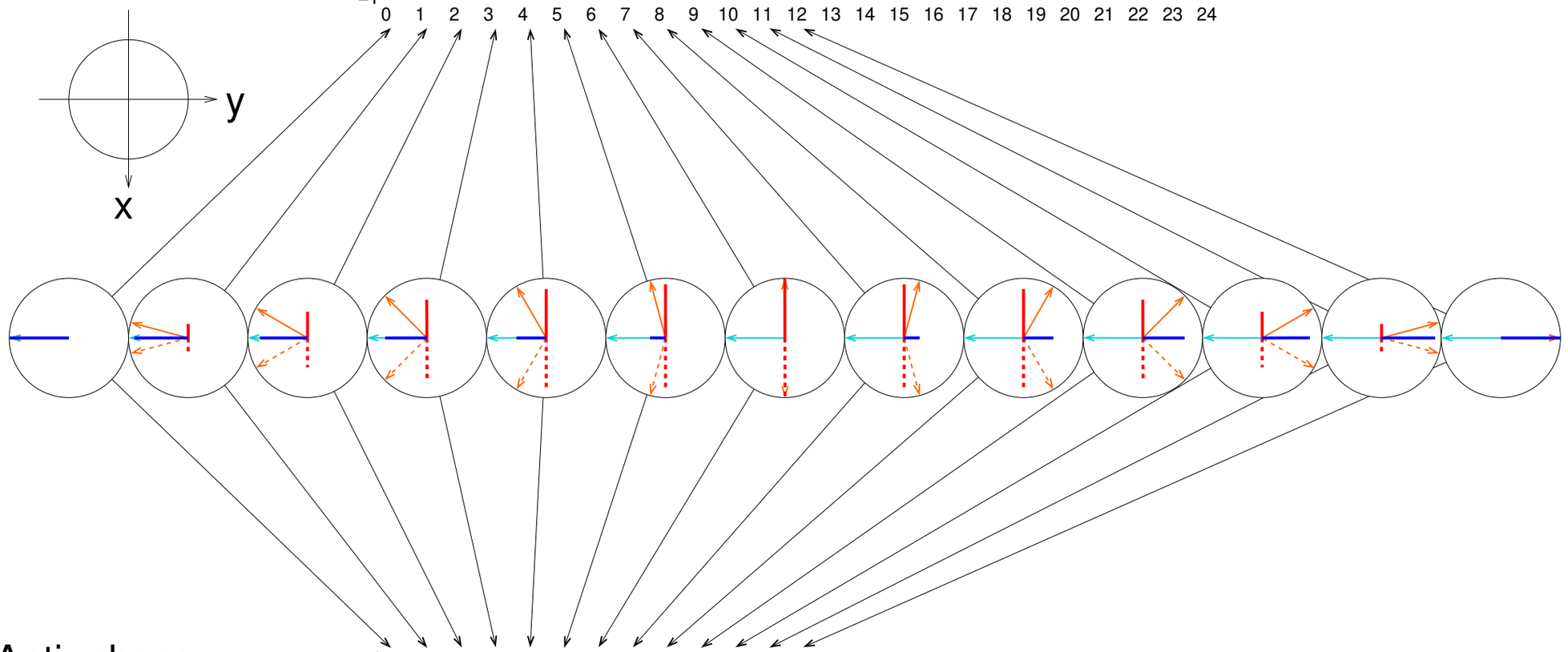
In–phase:

x:



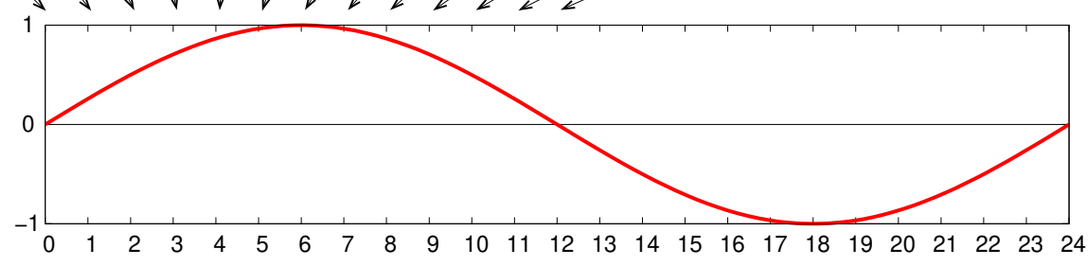
y:



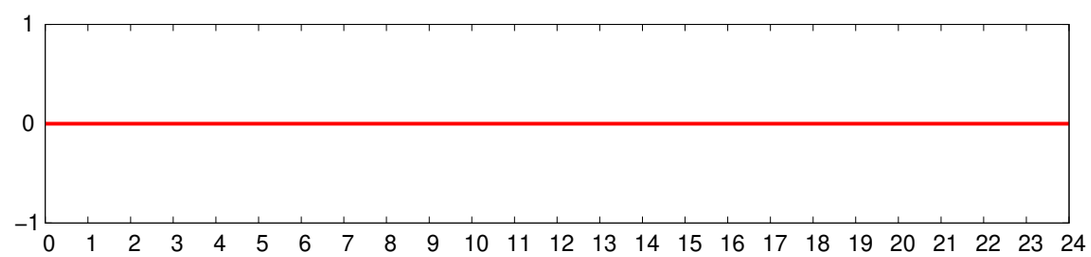


Anti–phase:

x:

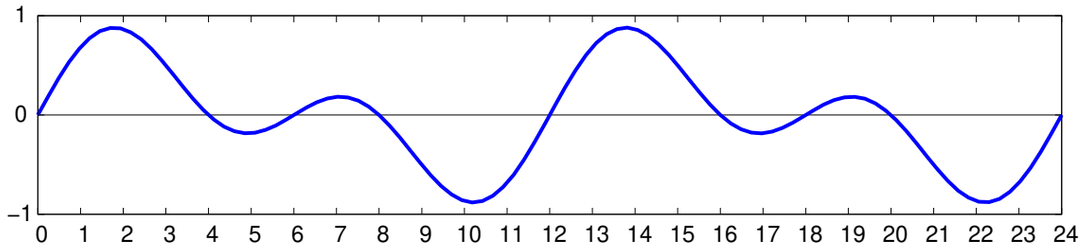


y:

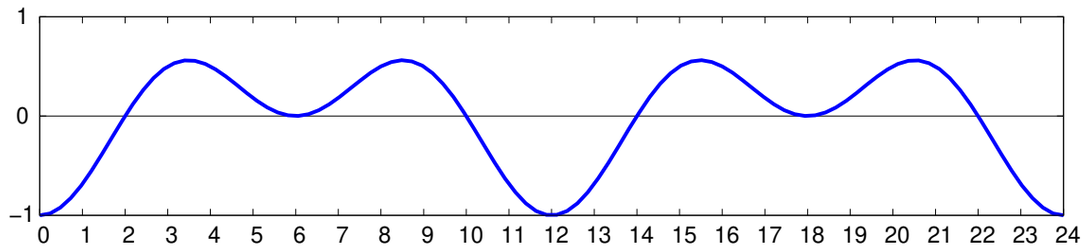


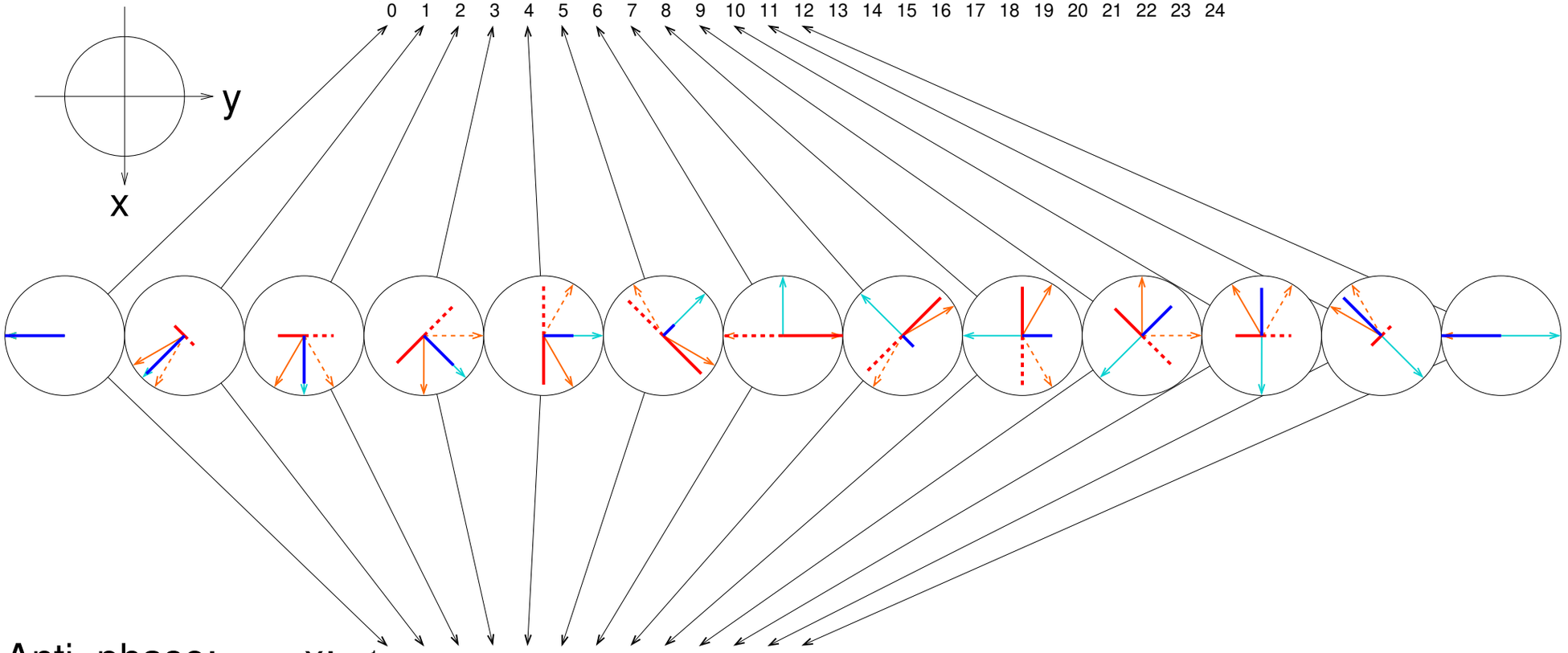
In–phase:

x:



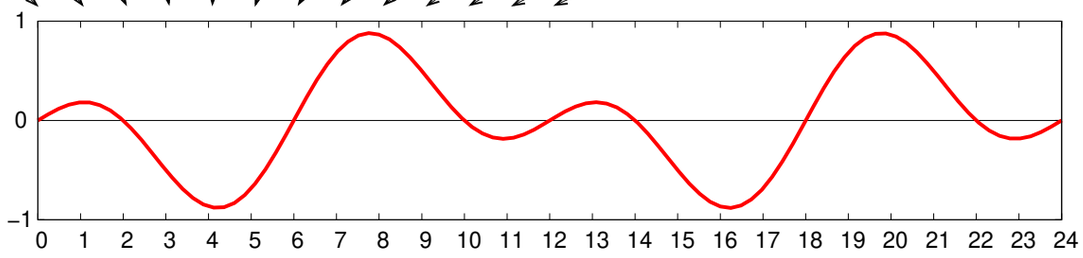
y:



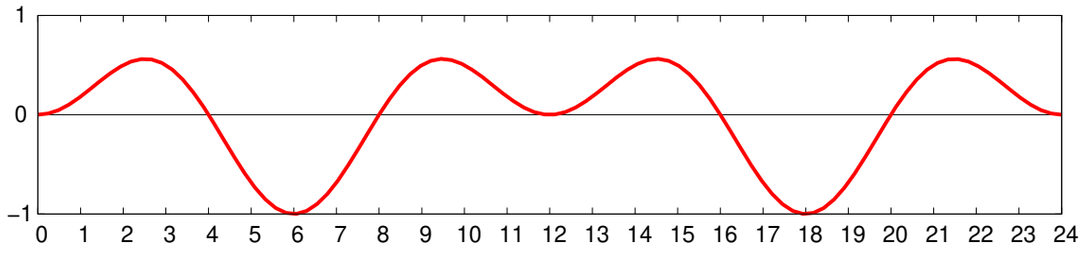


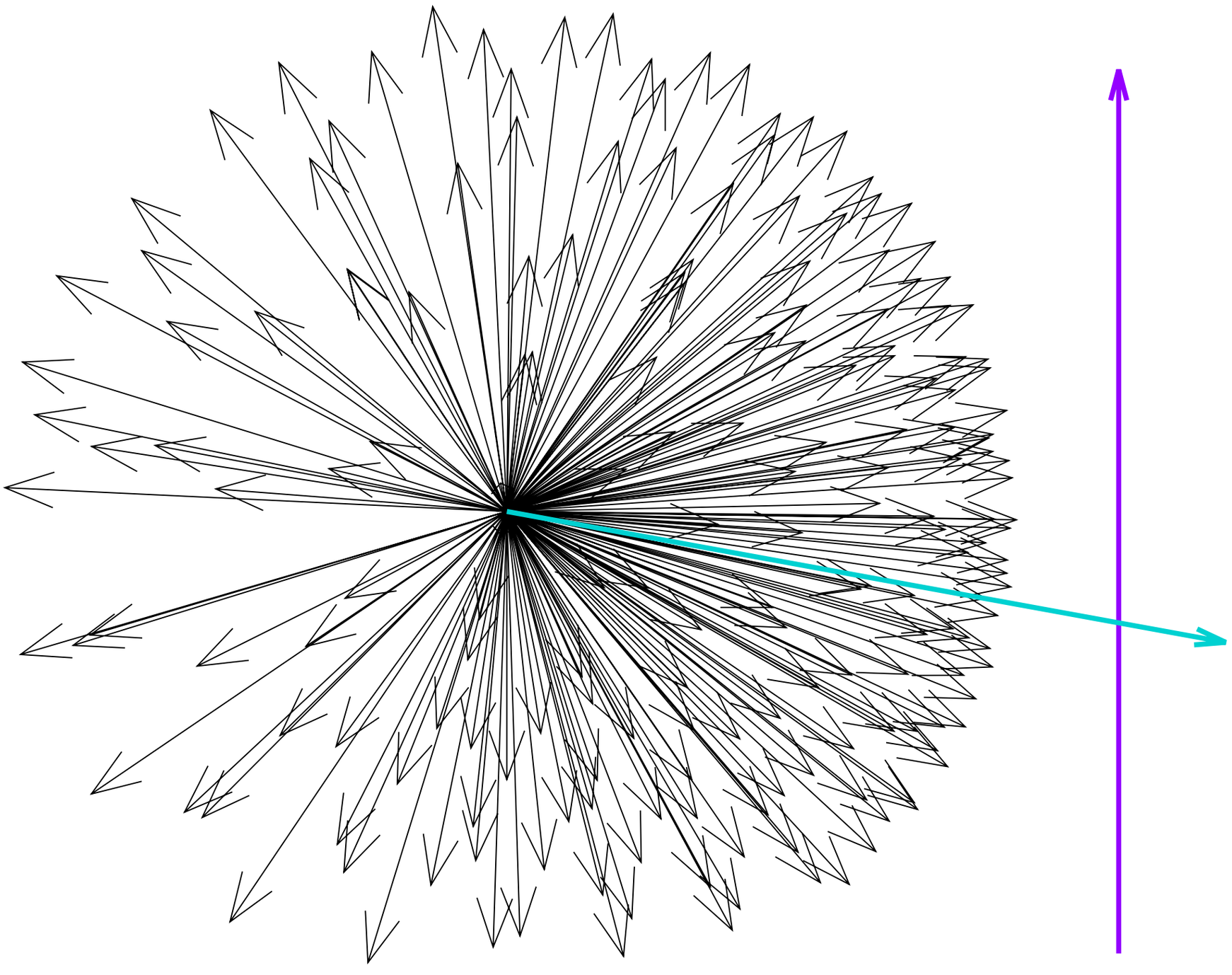
Anti–phase:

x:

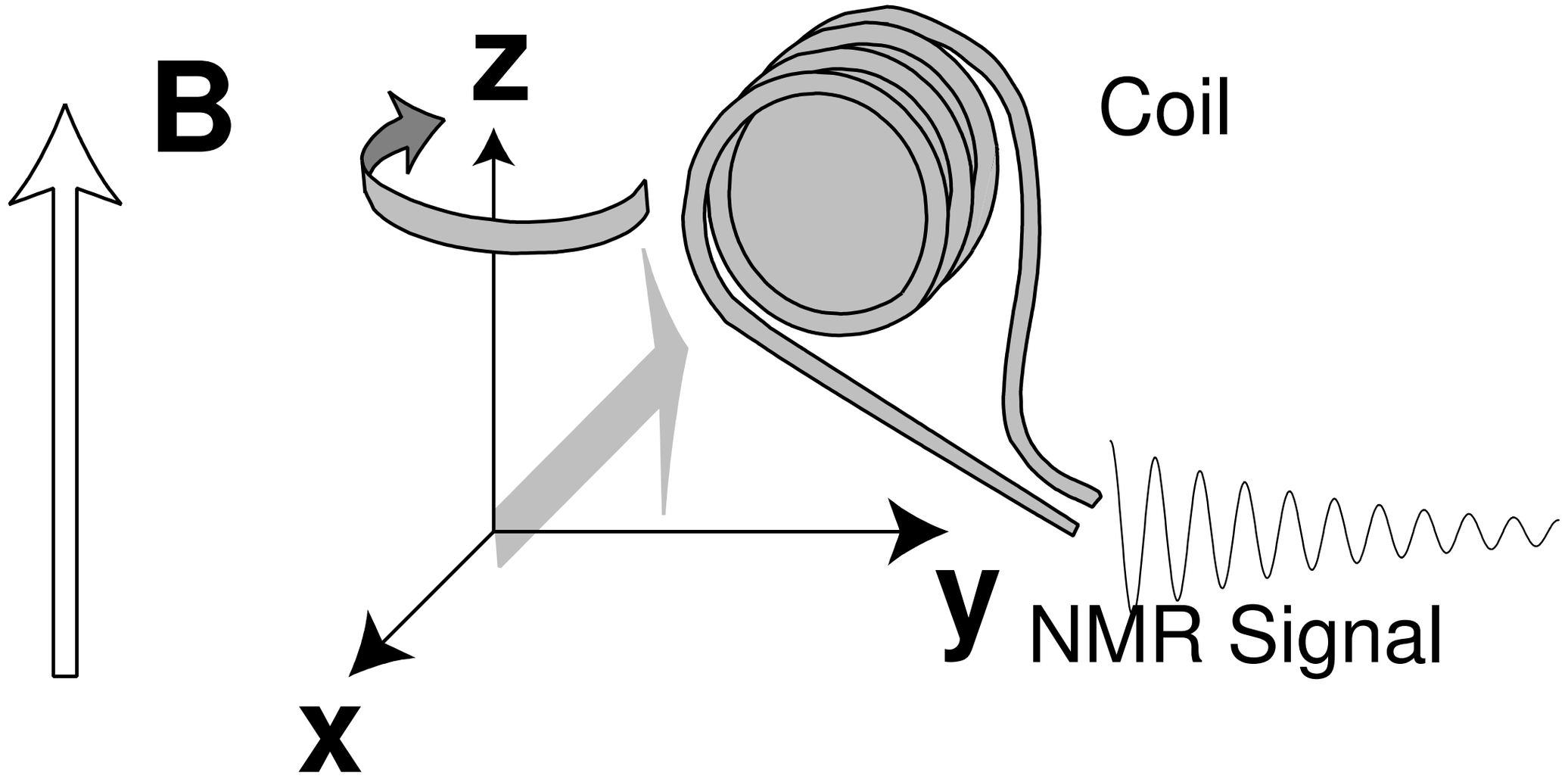


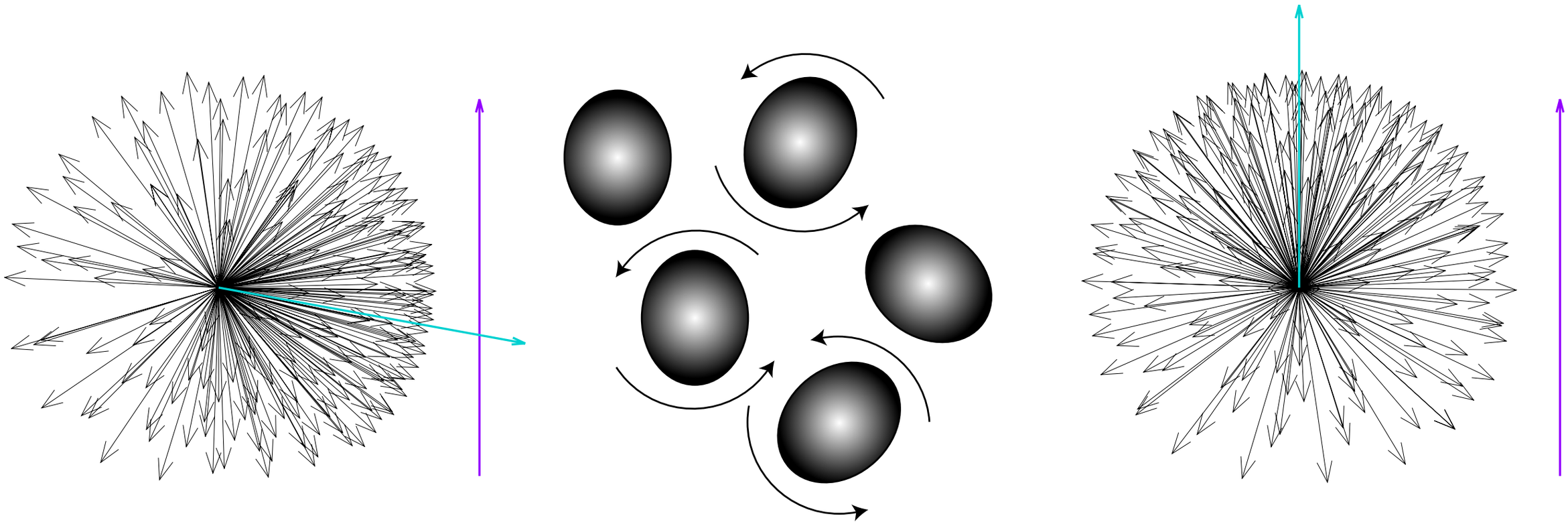
y:

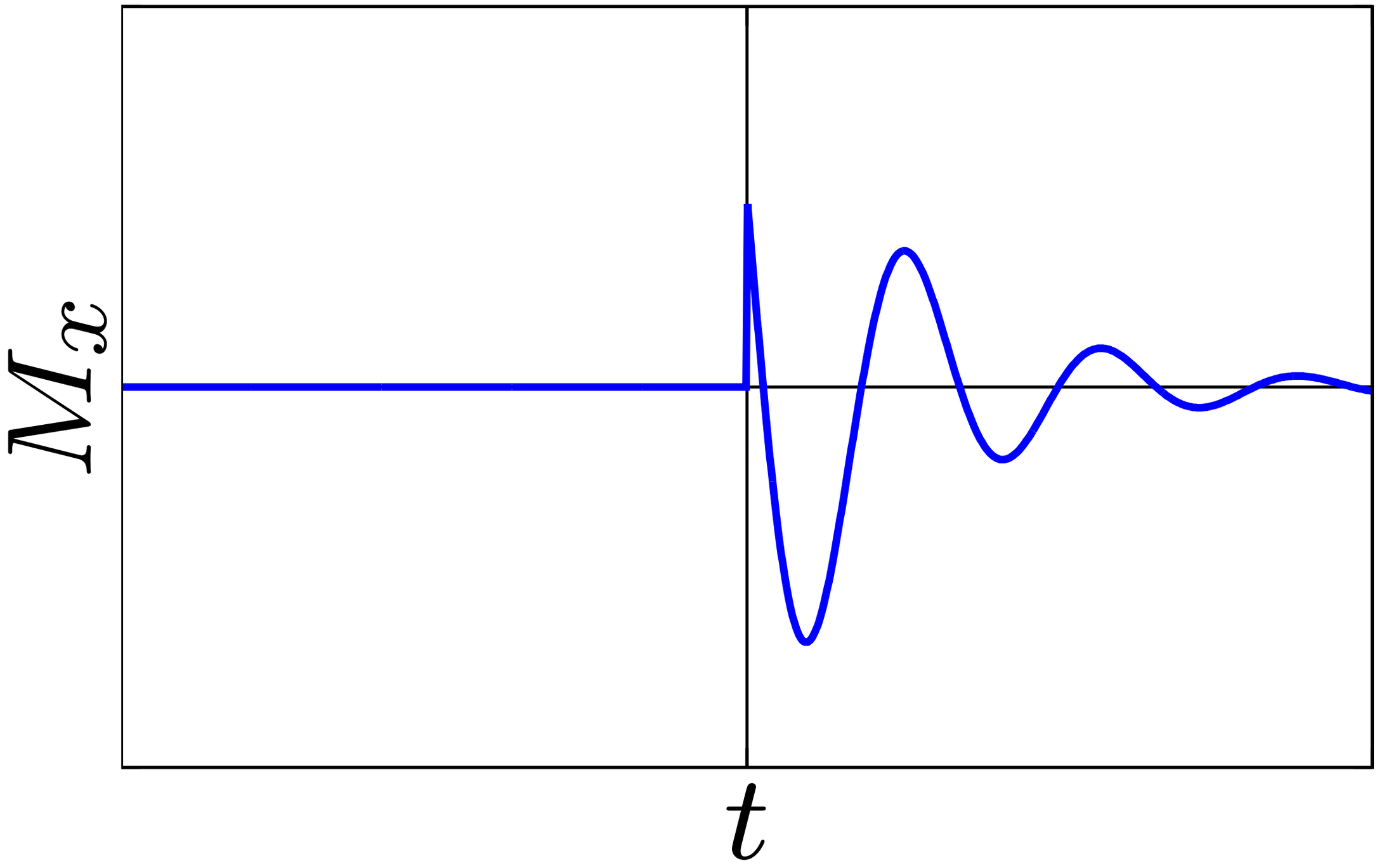


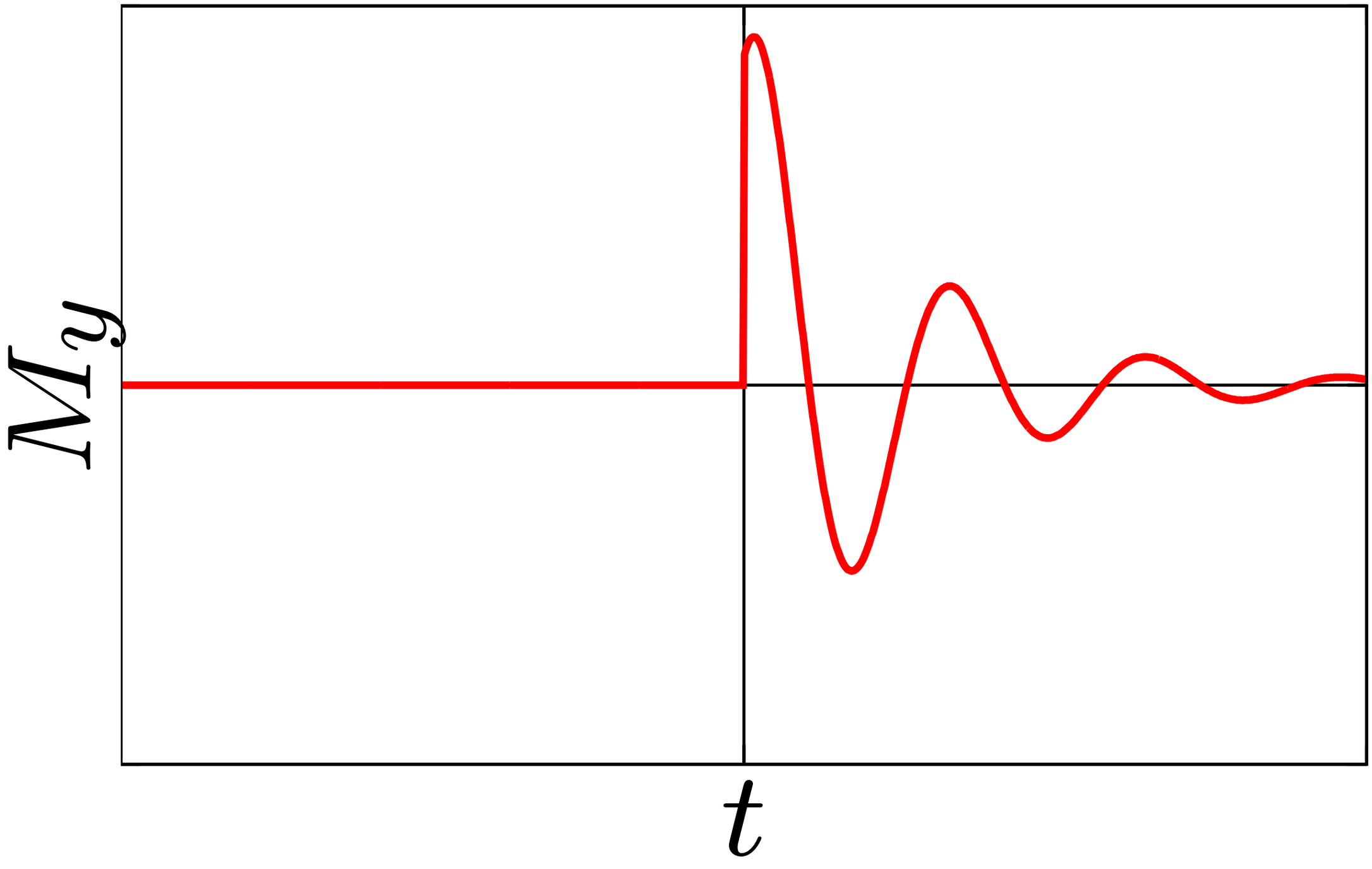


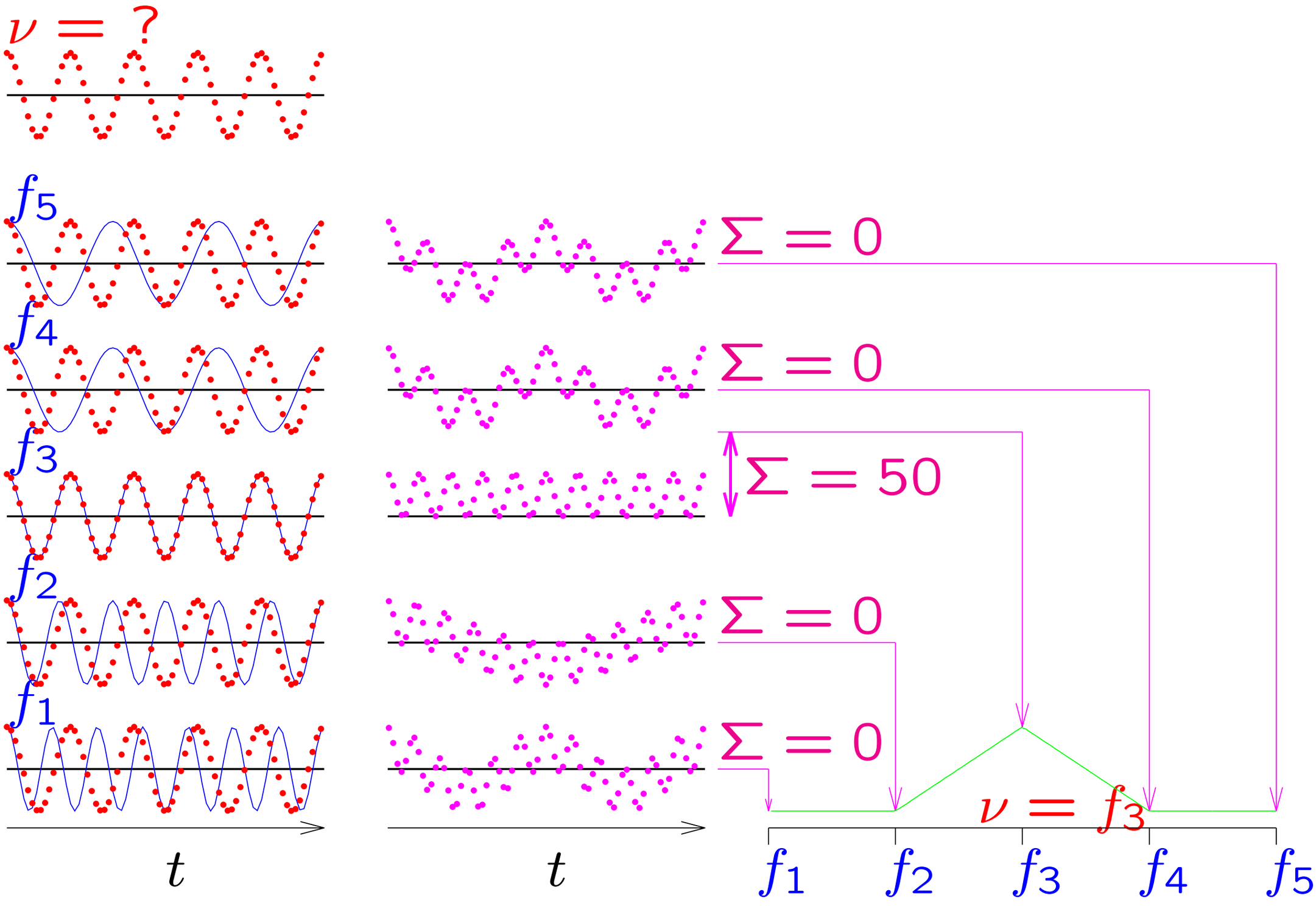
Transverse polarization

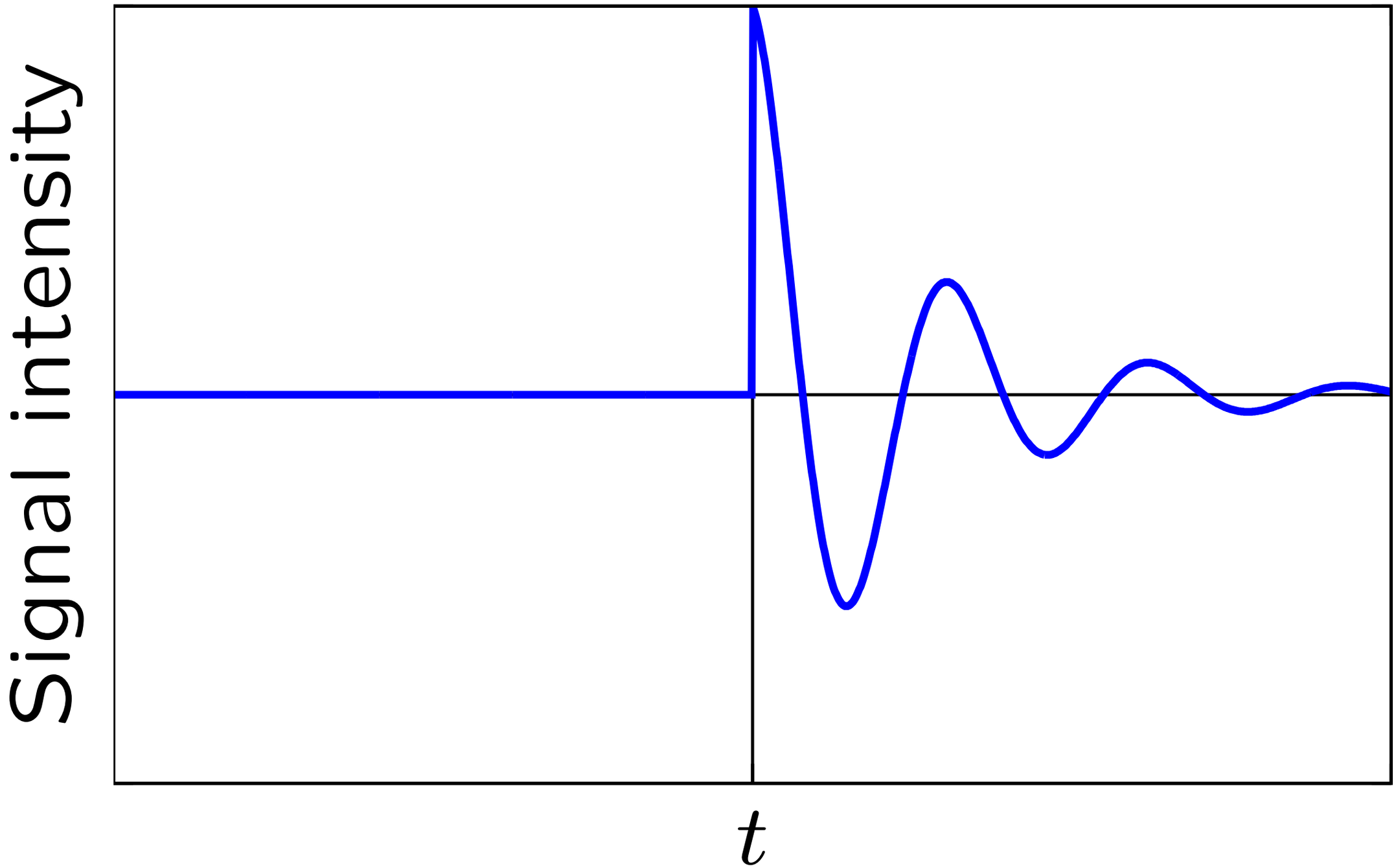

B
z
Coil
y
NMR Signal
x

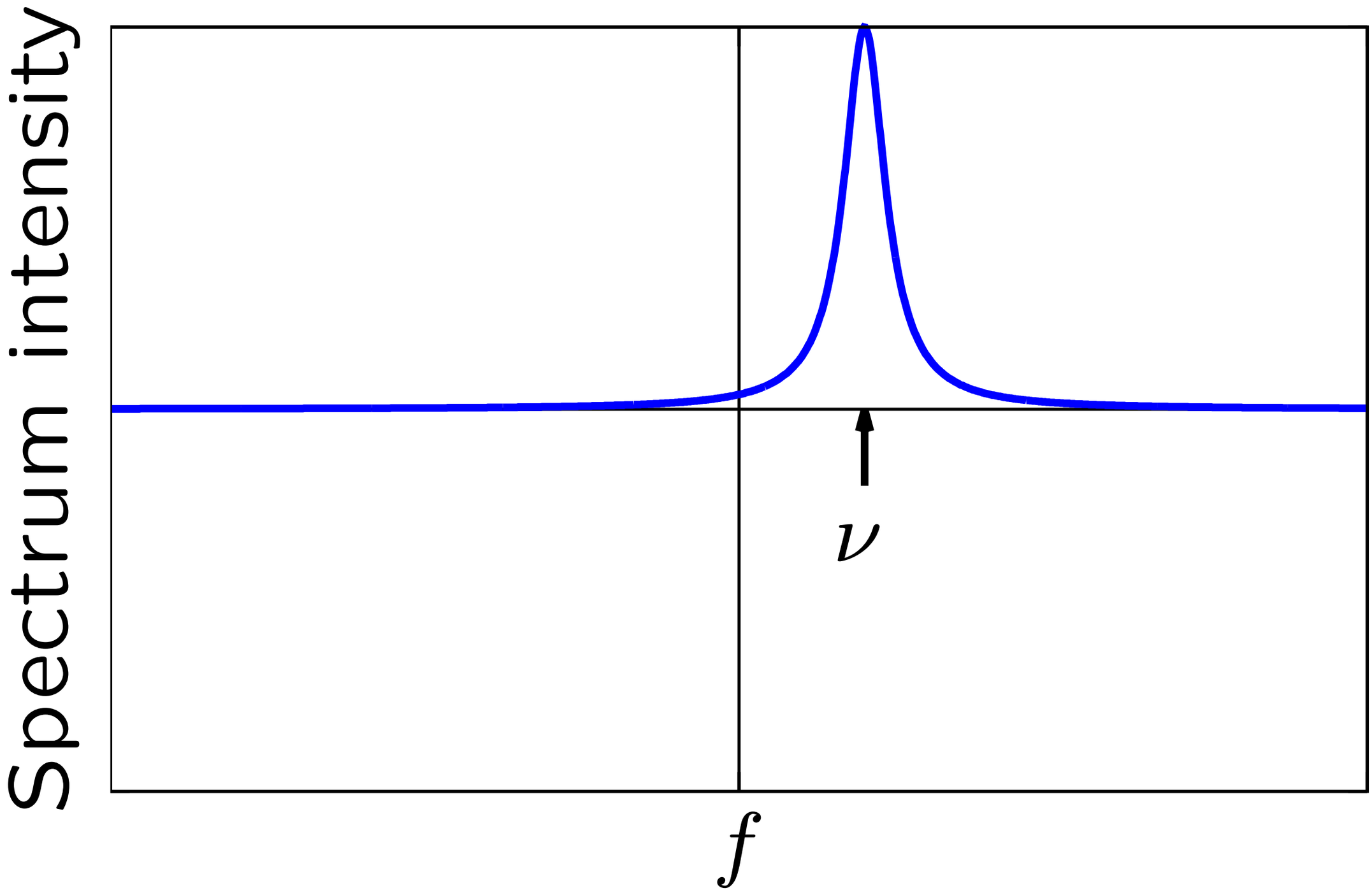


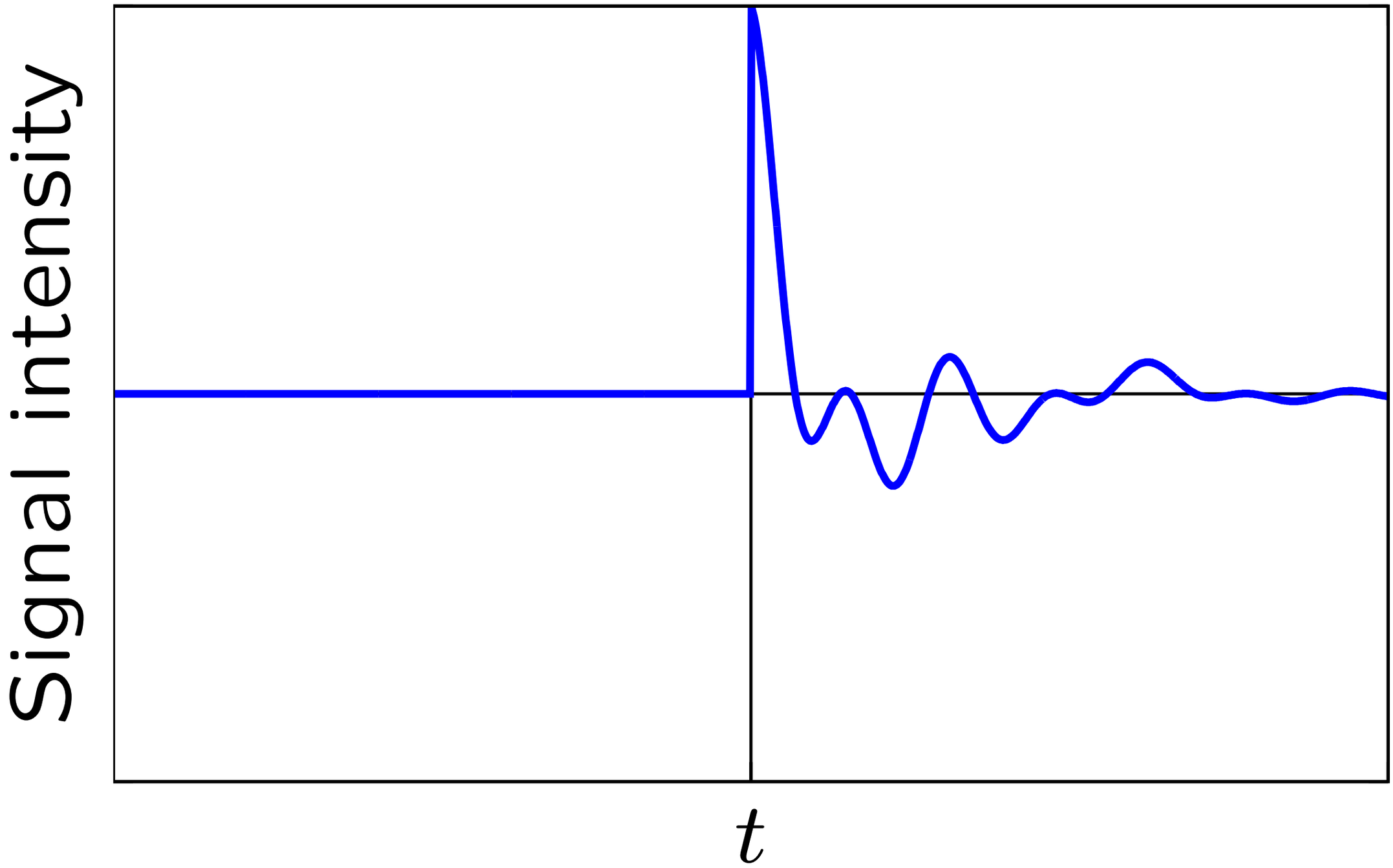

M_x
t

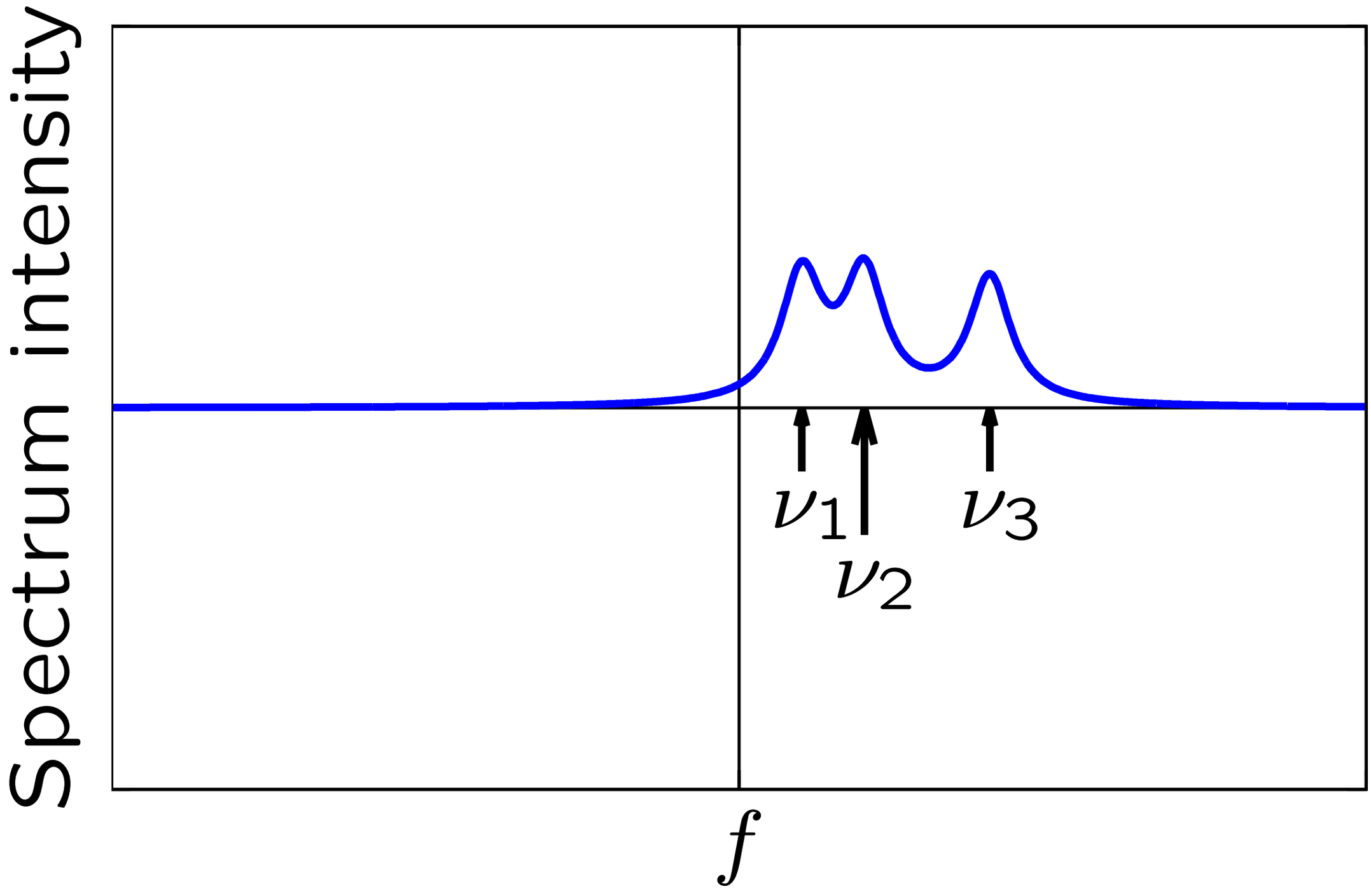

M_y
t

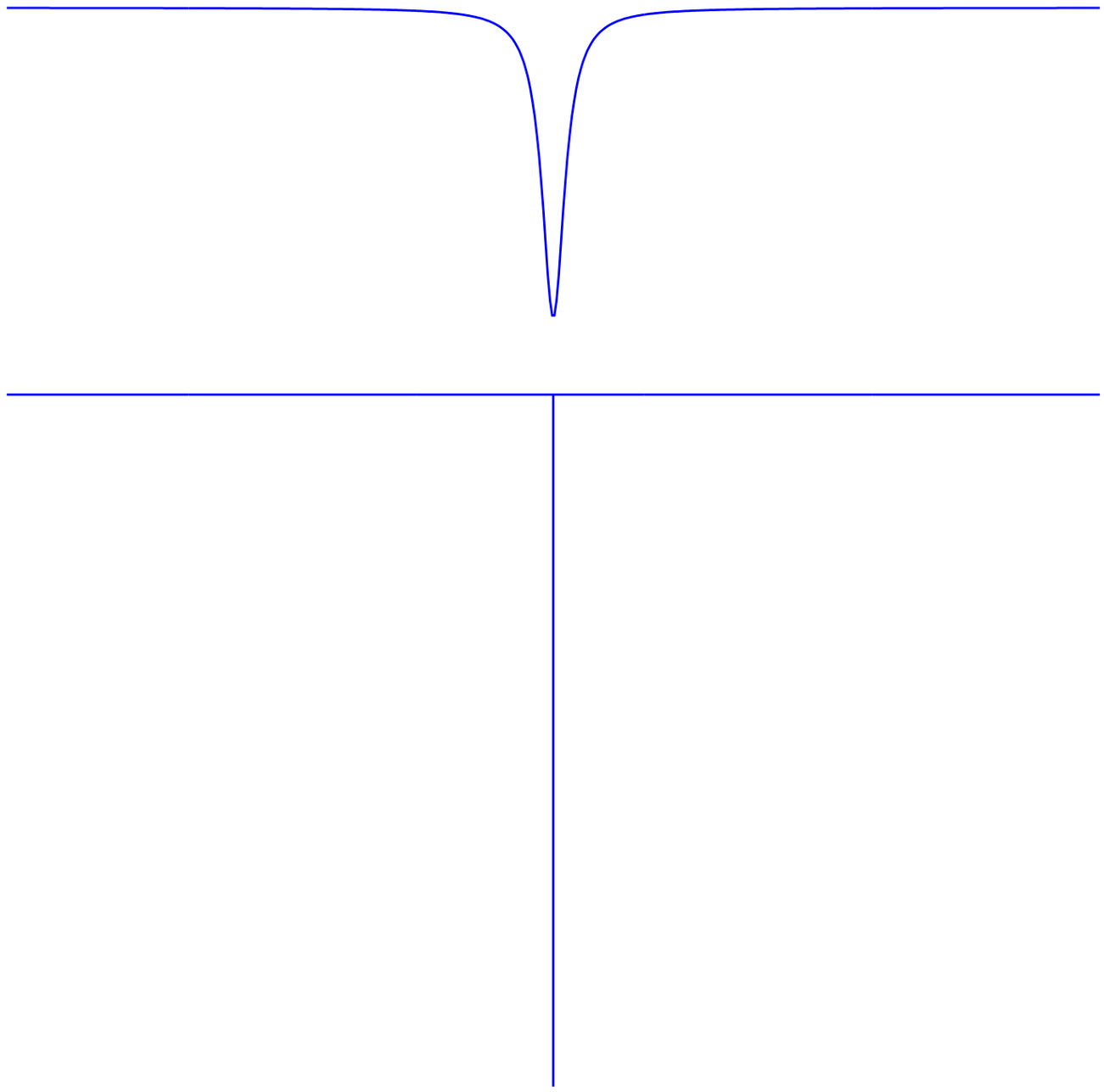

$\nu = ?$
f_5
f_4
f_3
f_2
f_1
$\Sigma = 0$
$\Sigma = 0$
$\Sigma = 50$
$\Sigma = 0$
$\Sigma = 0$
t
t
$\nu = f_3$
f_1
f_2
f_3
f_4
f_5

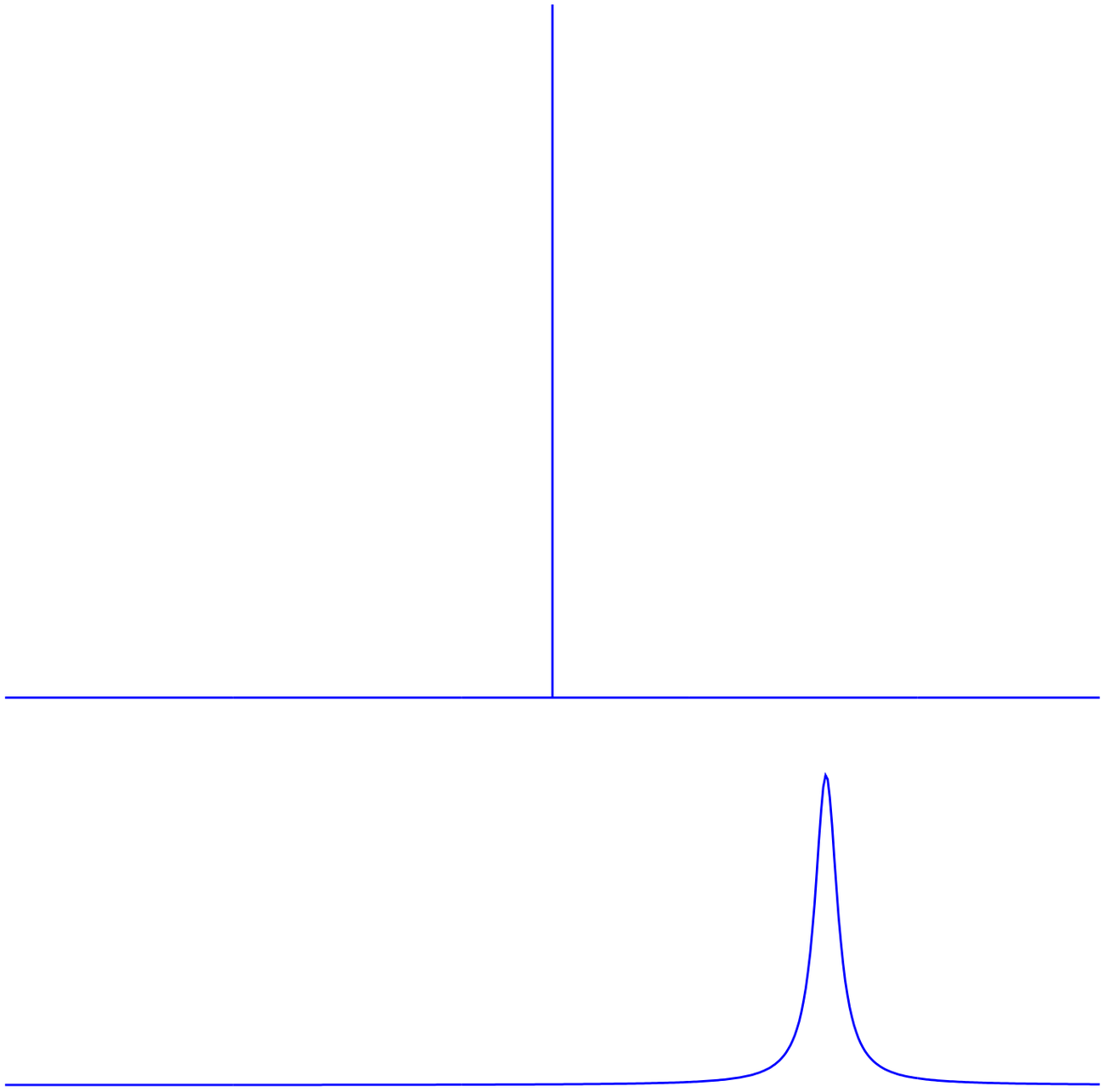

Signal intensity
t

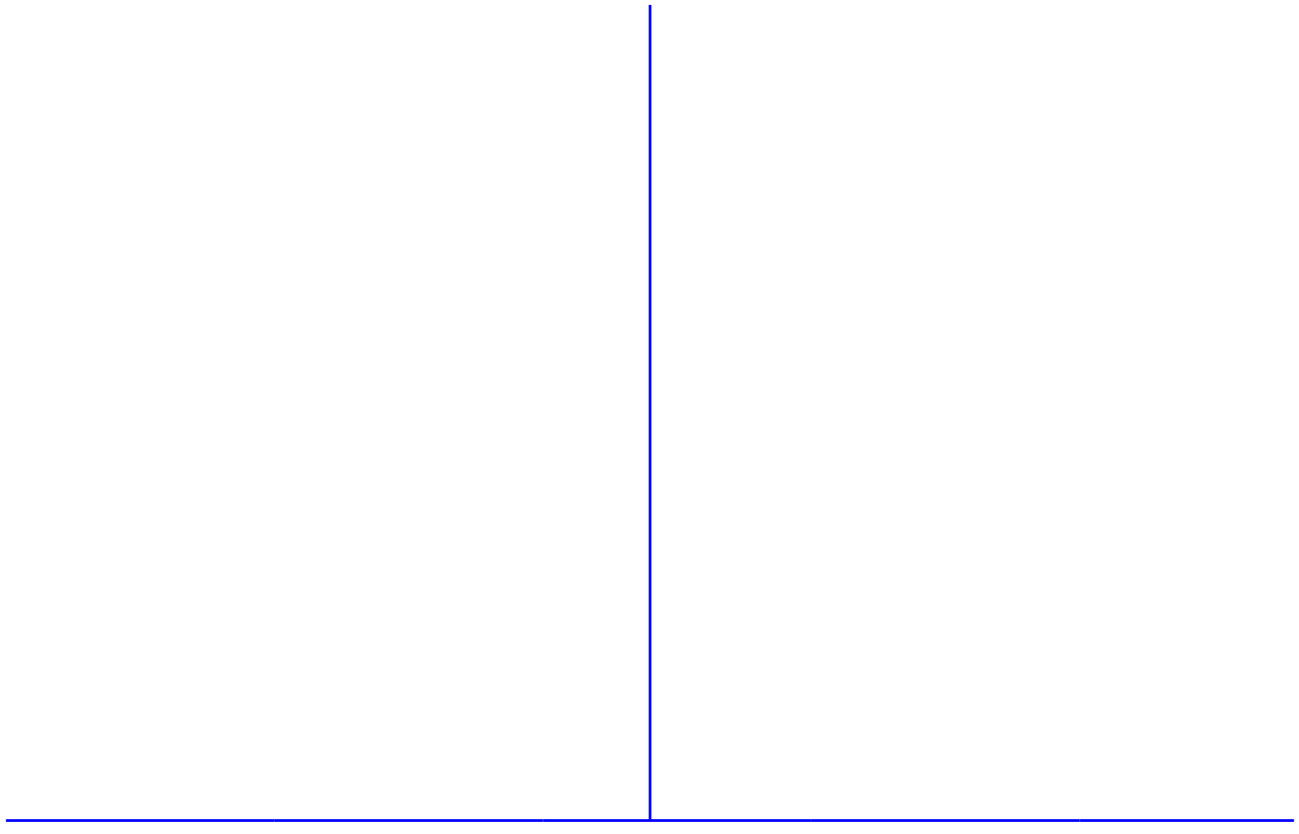

Spectrum intensity
ν
f

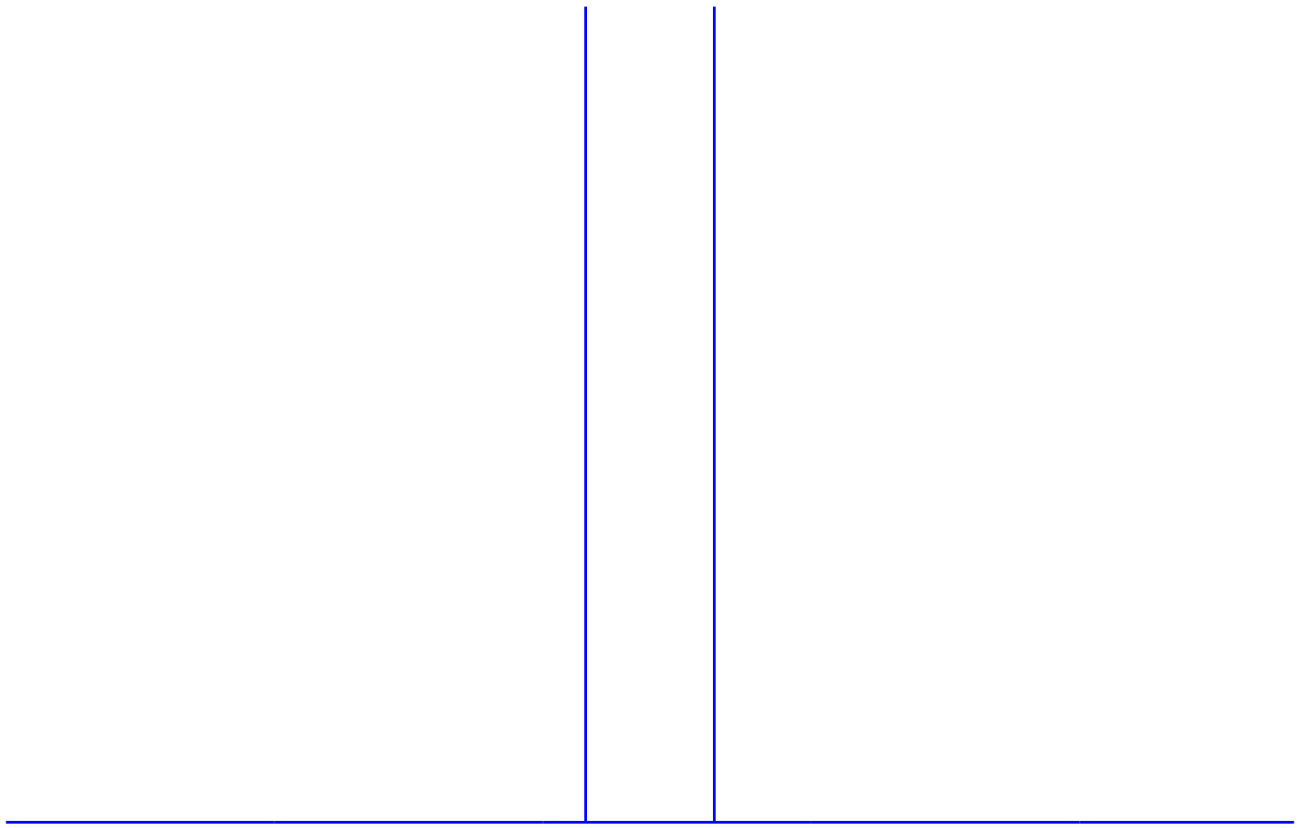

Signal intensity
t

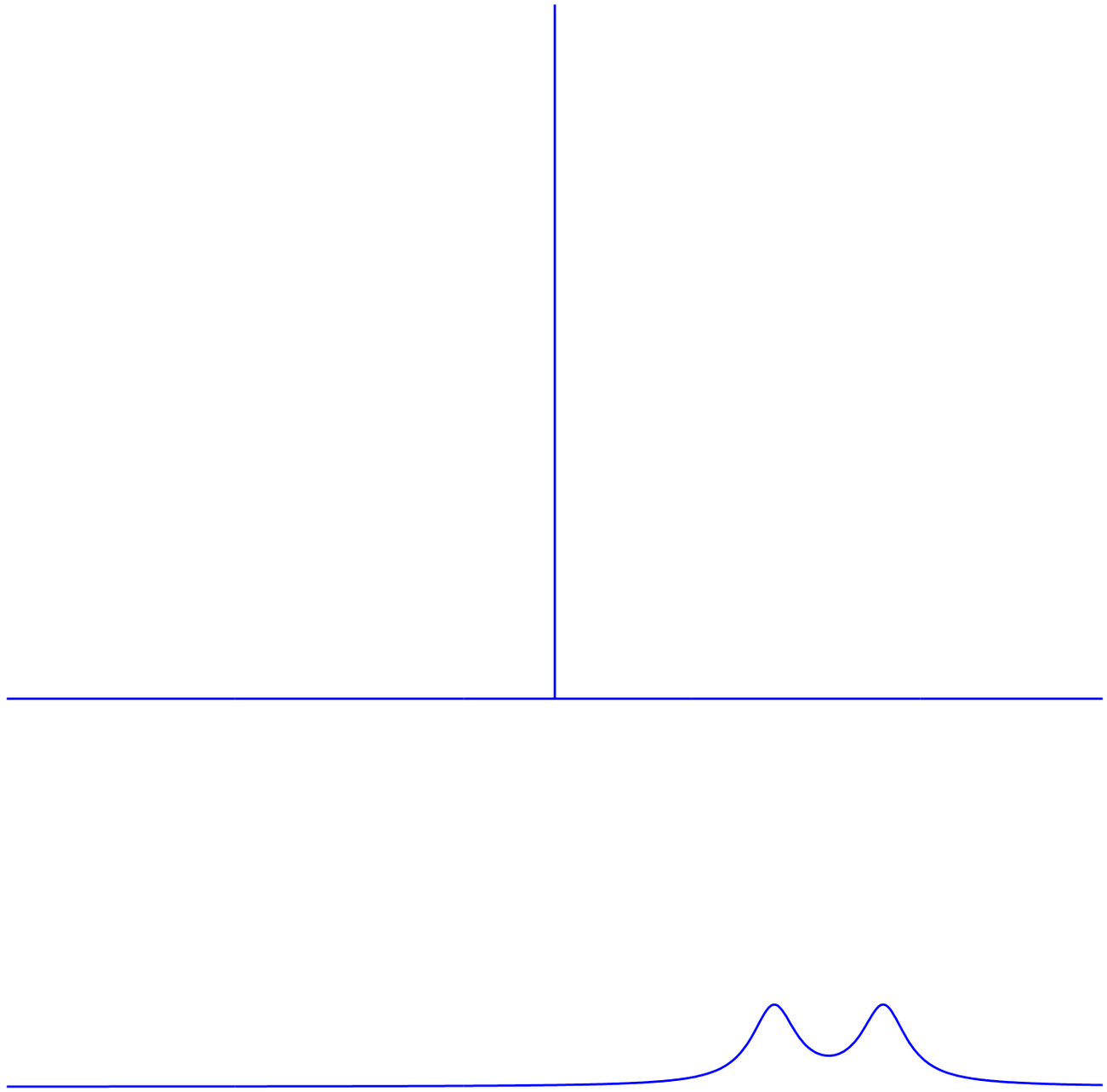

Spectrum intensity
ν_1
ν_2
ν_3
f







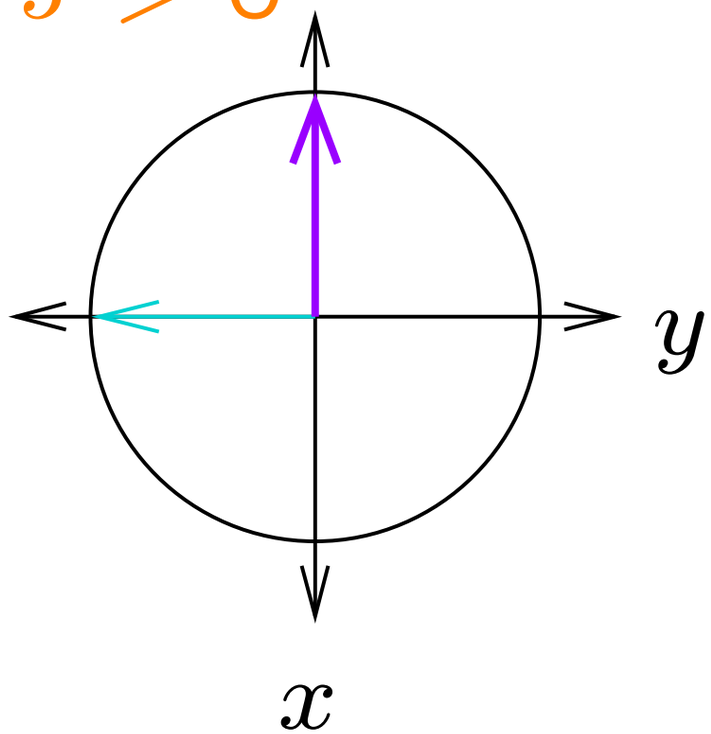




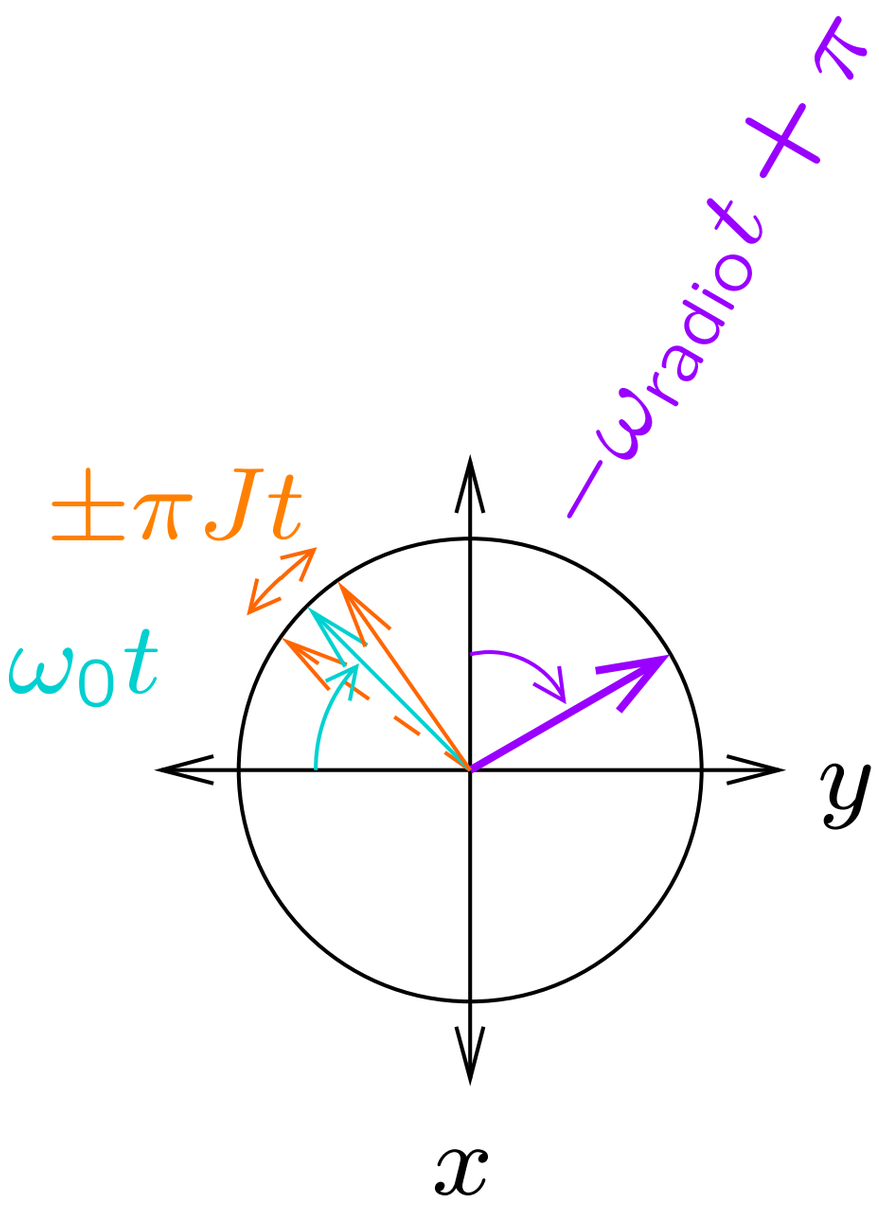
$\gamma > 0,\ \Omega > 0$

$J > 0$

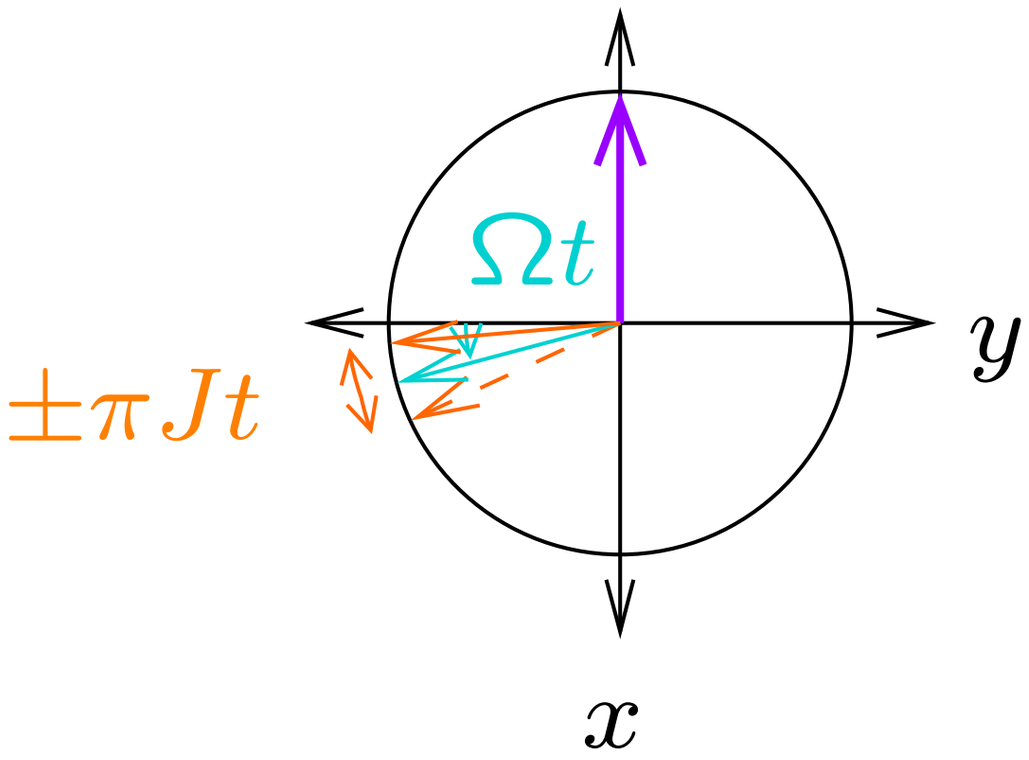
$t = 0$

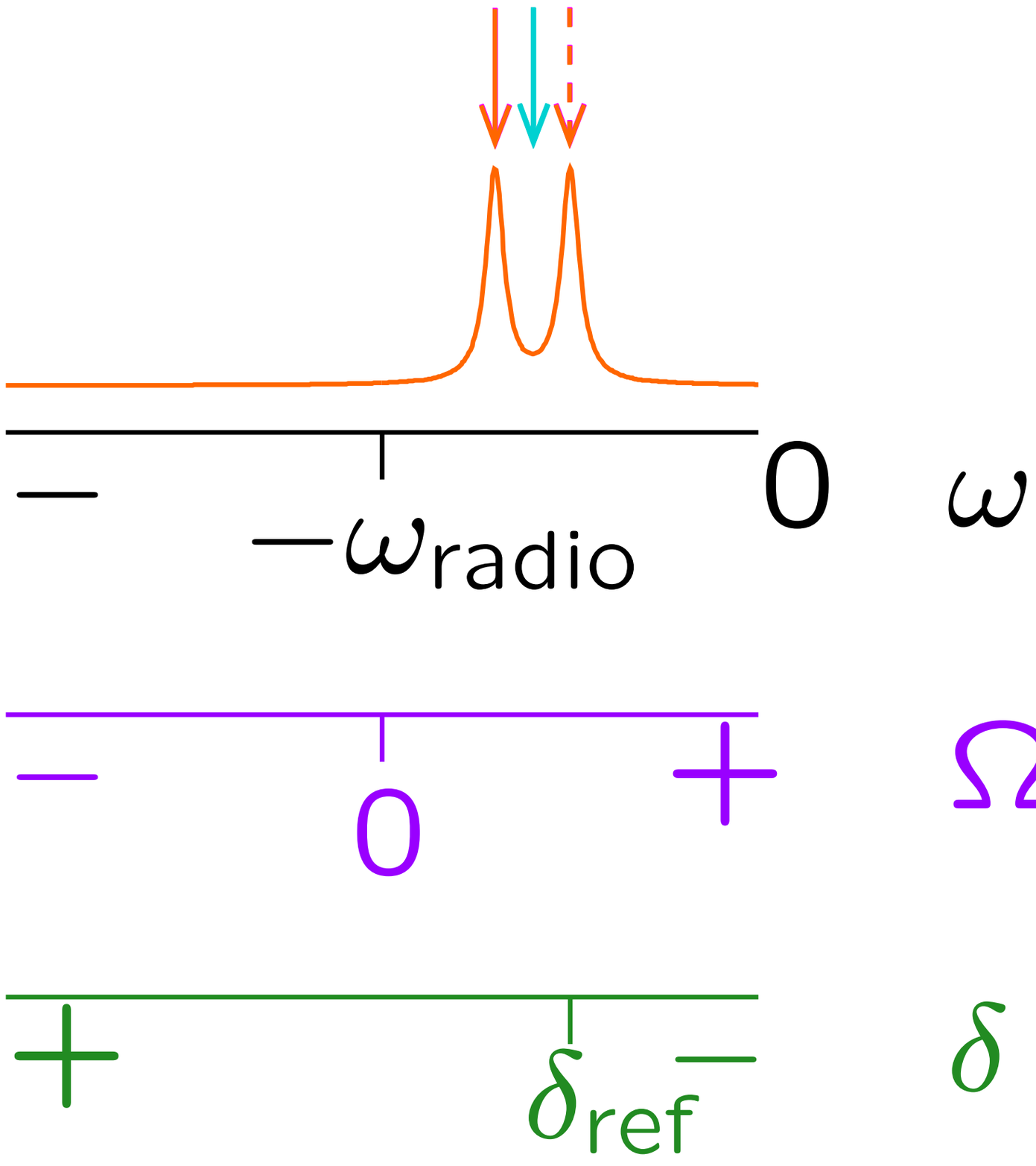


$t > 0$



$t > 0$

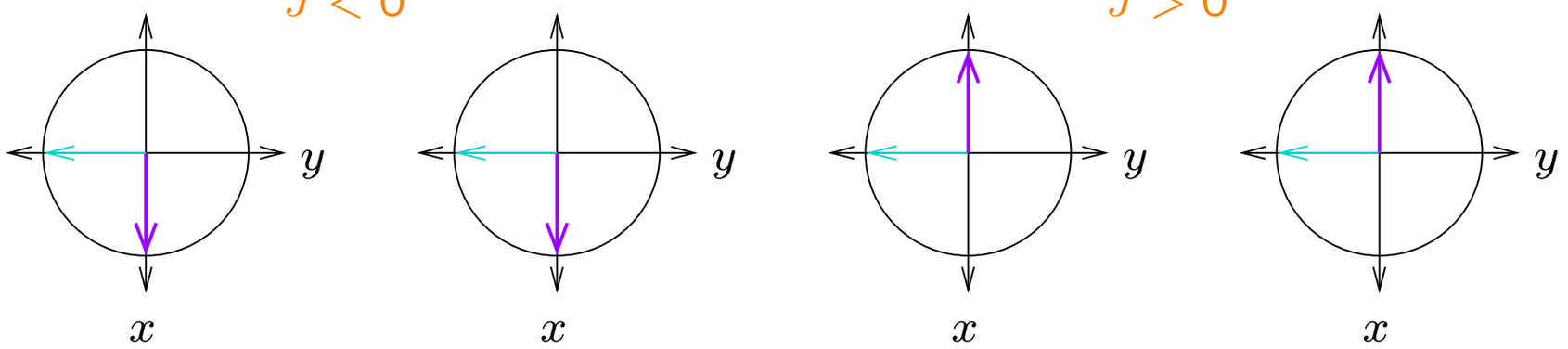



−
−ωradio
0
ω
−
0
+
Ω
+
δref
−
δ

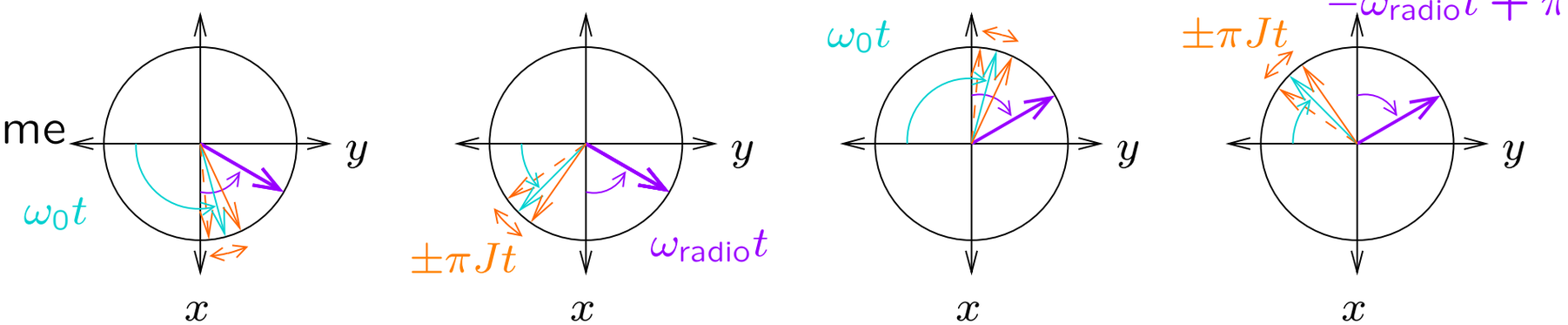
$\gamma < 0,\ \Omega < 0$ $\gamma < 0,\ \Omega > 0$ $\gamma > 0,\ \Omega < 0$ $\gamma > 0,\ \Omega > 0$

$J < 0$ $J > 0$

$t = 0$



Laboratory frame
$t > 0$



Rotating frame
$t > 0$