Eletromagnetismo Avançado

1º ciclo
Aula de 3 setembro

Ondas eletromagnéticas

$$\nabla^2 \vec{\mathbf{E}} = \mu_0 \epsilon_0 \frac{\partial^2 \vec{\mathbf{E}}}{\partial t^2}$$

$$\nabla^2 \vec{\mathbf{B}} = \mu_0 \epsilon_0 \frac{\partial^2 \vec{\mathbf{B}}}{\partial t^2}$$

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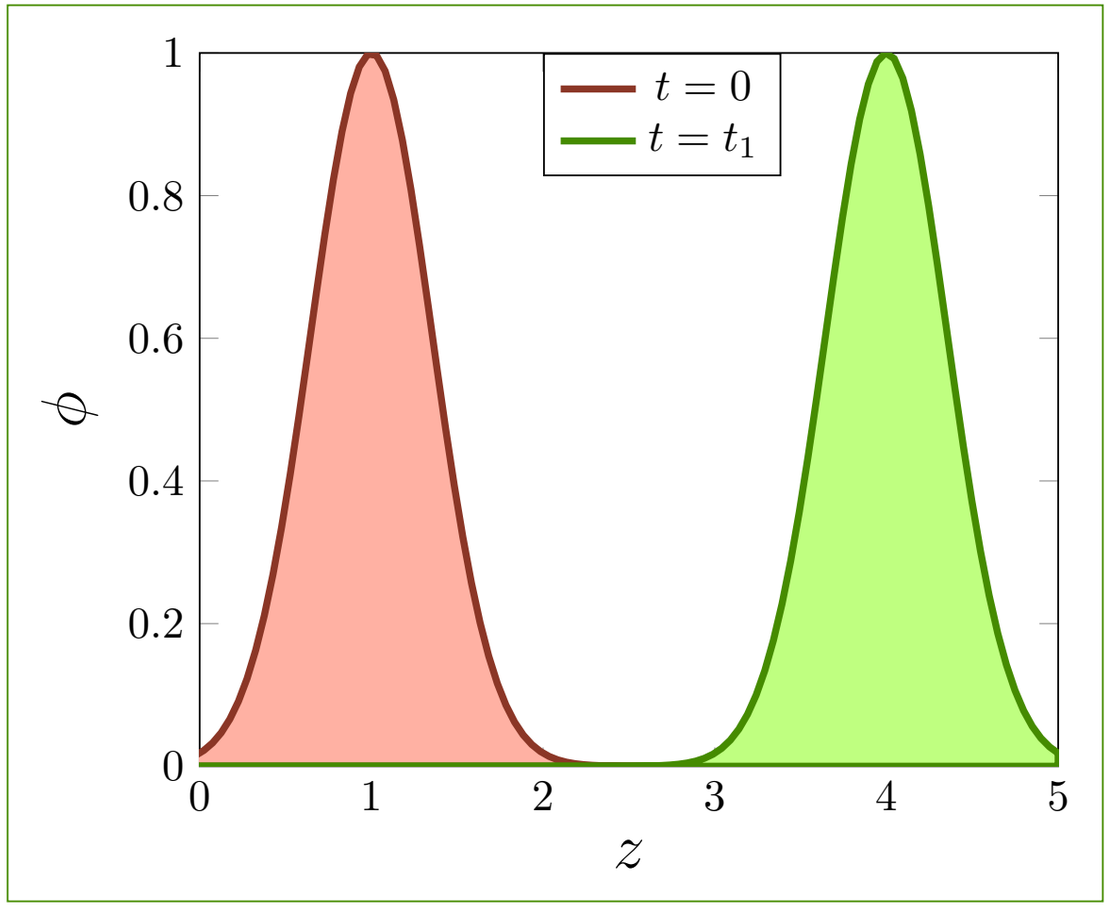
$$\nabla^2 \phi = \frac{1}{v^2} \frac{\partial^2 \phi}{\partial t^2}$$

$$\phi_{\vec{\mathbf{k}}}(\vec{\mathbf{r}}, t) = f(\vec{\mathbf{k}} \cdot \vec{r} - \omega t) \qquad (\omega = kv)$$



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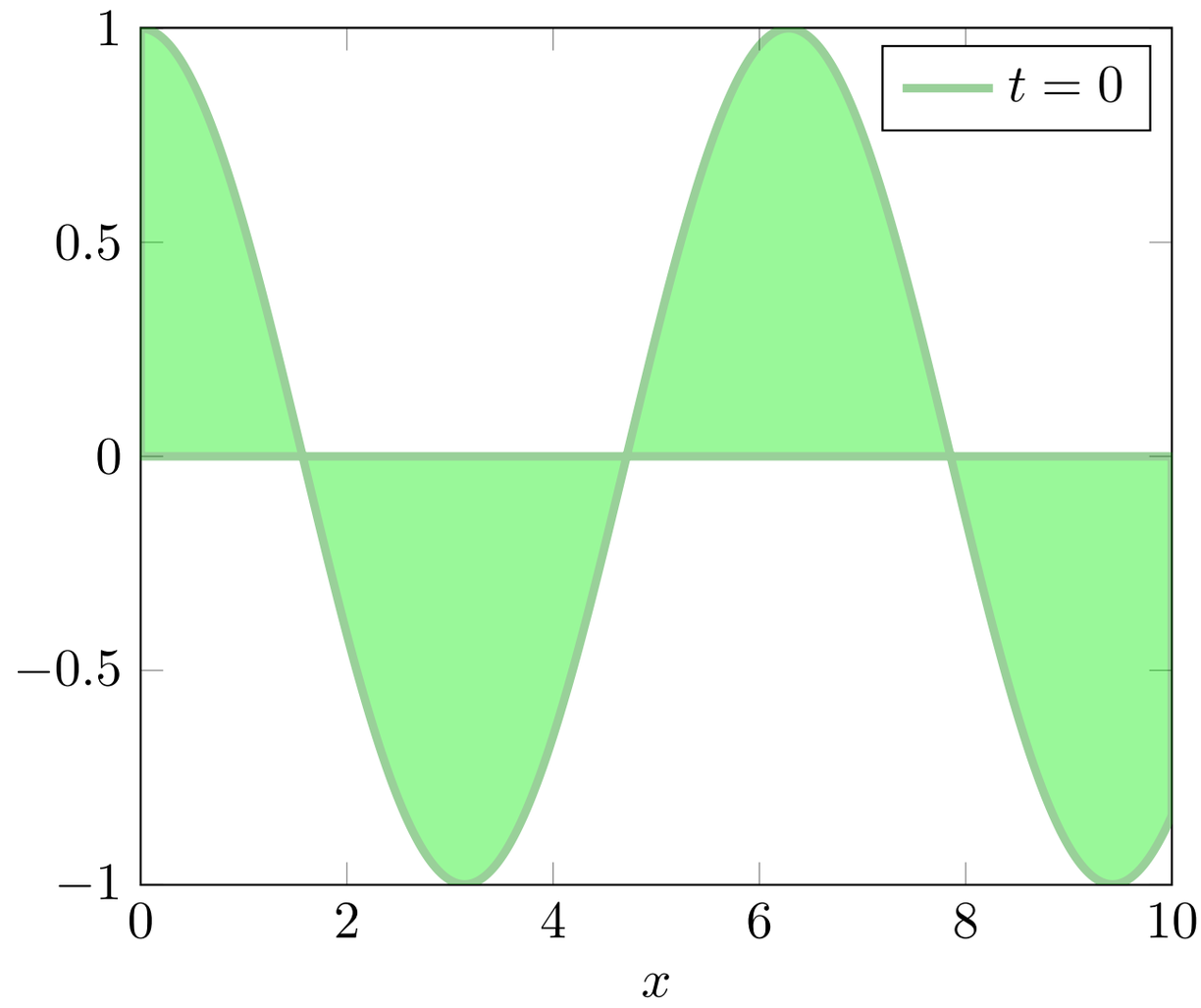

Ondas planas

$$\vec{E} = \vec{E}_0 e^{i(kz-\omega t)}$$

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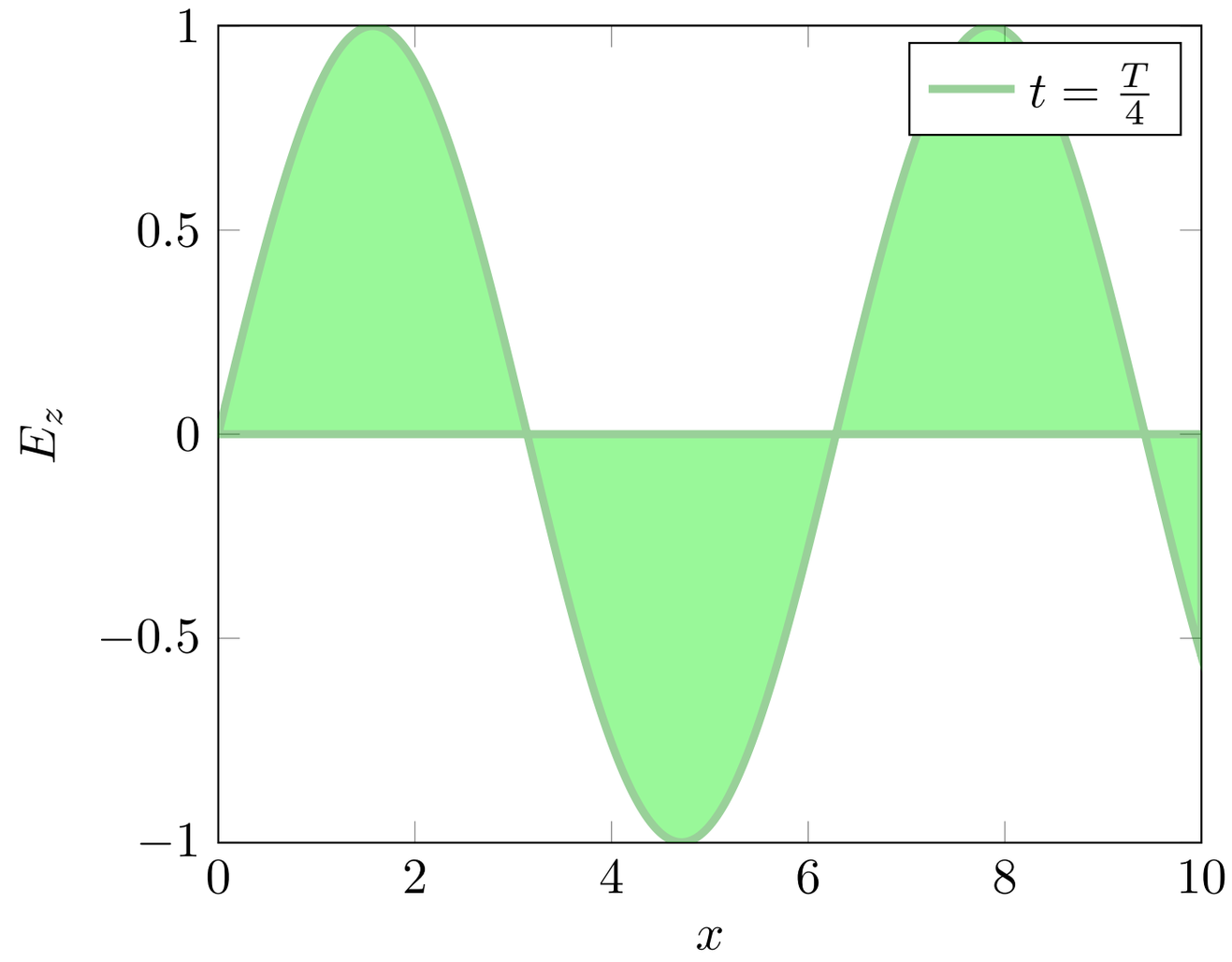

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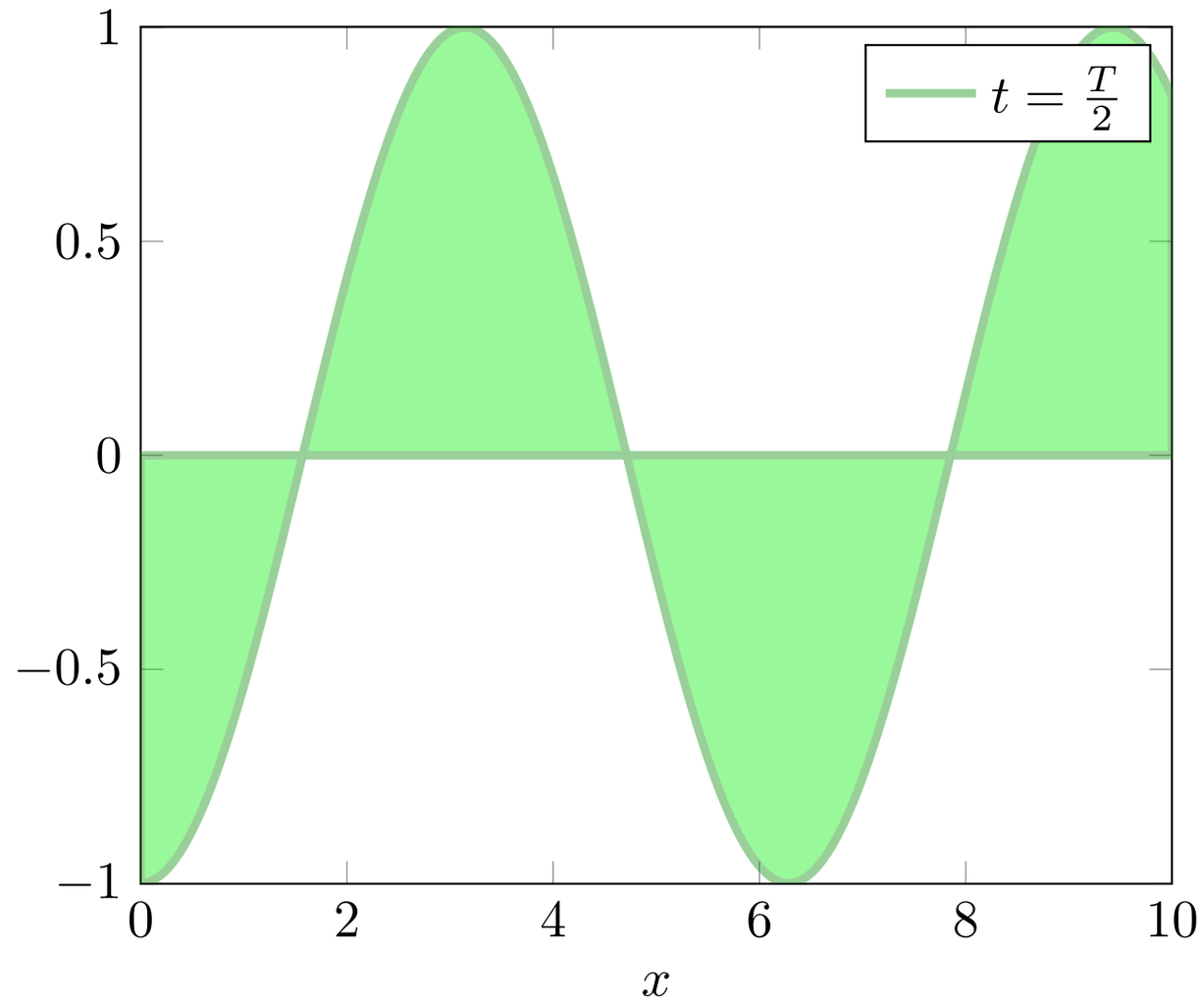

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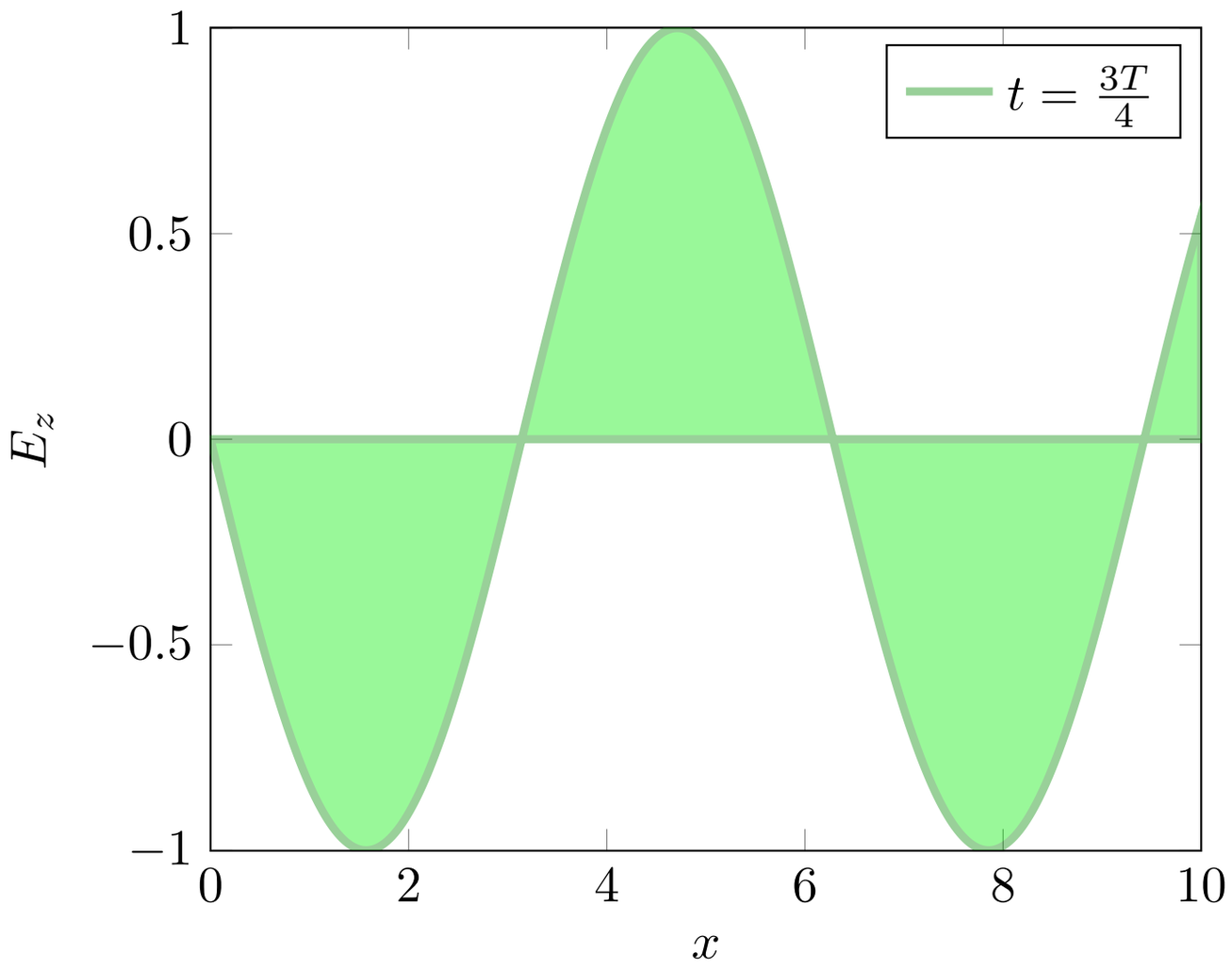

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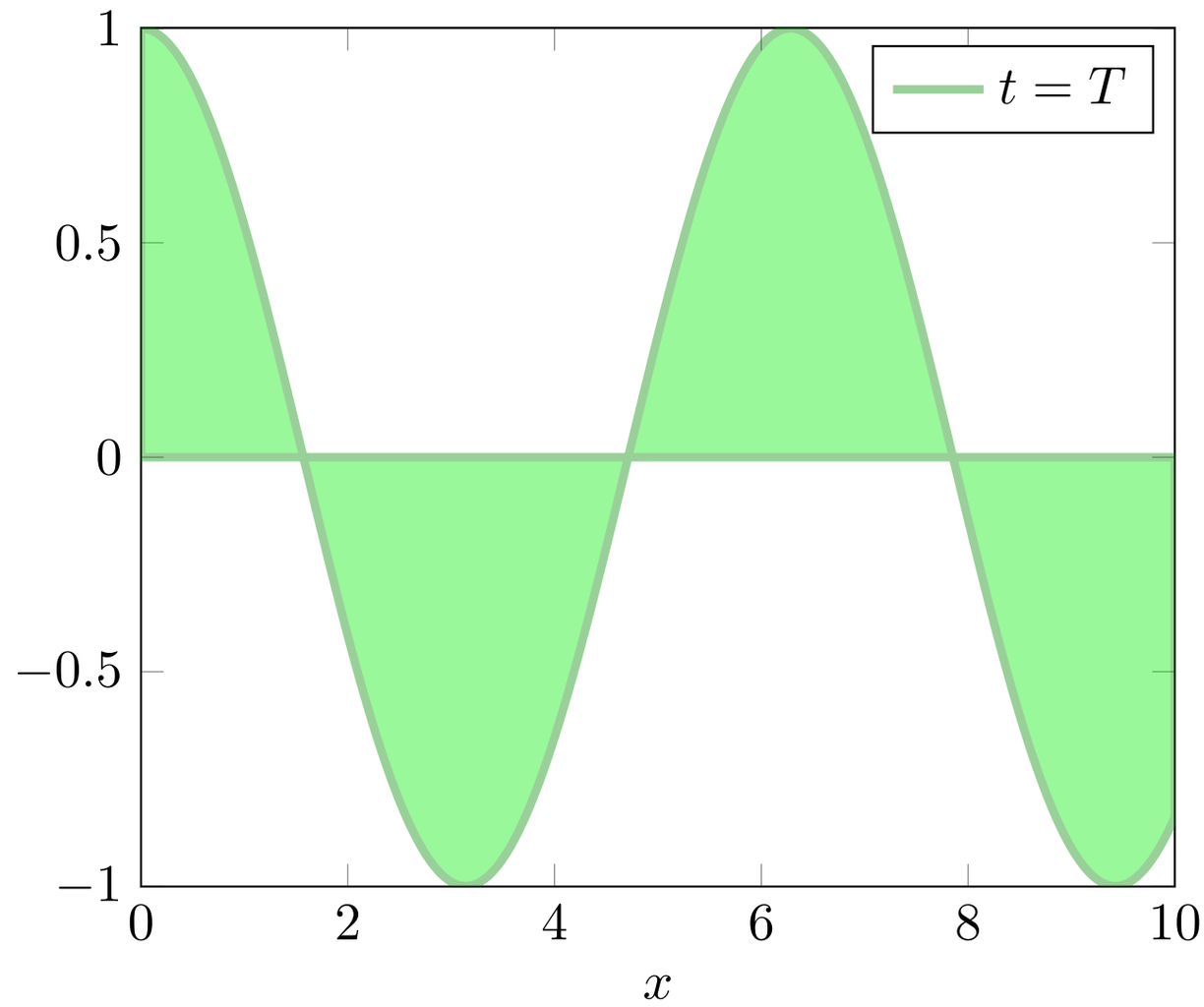

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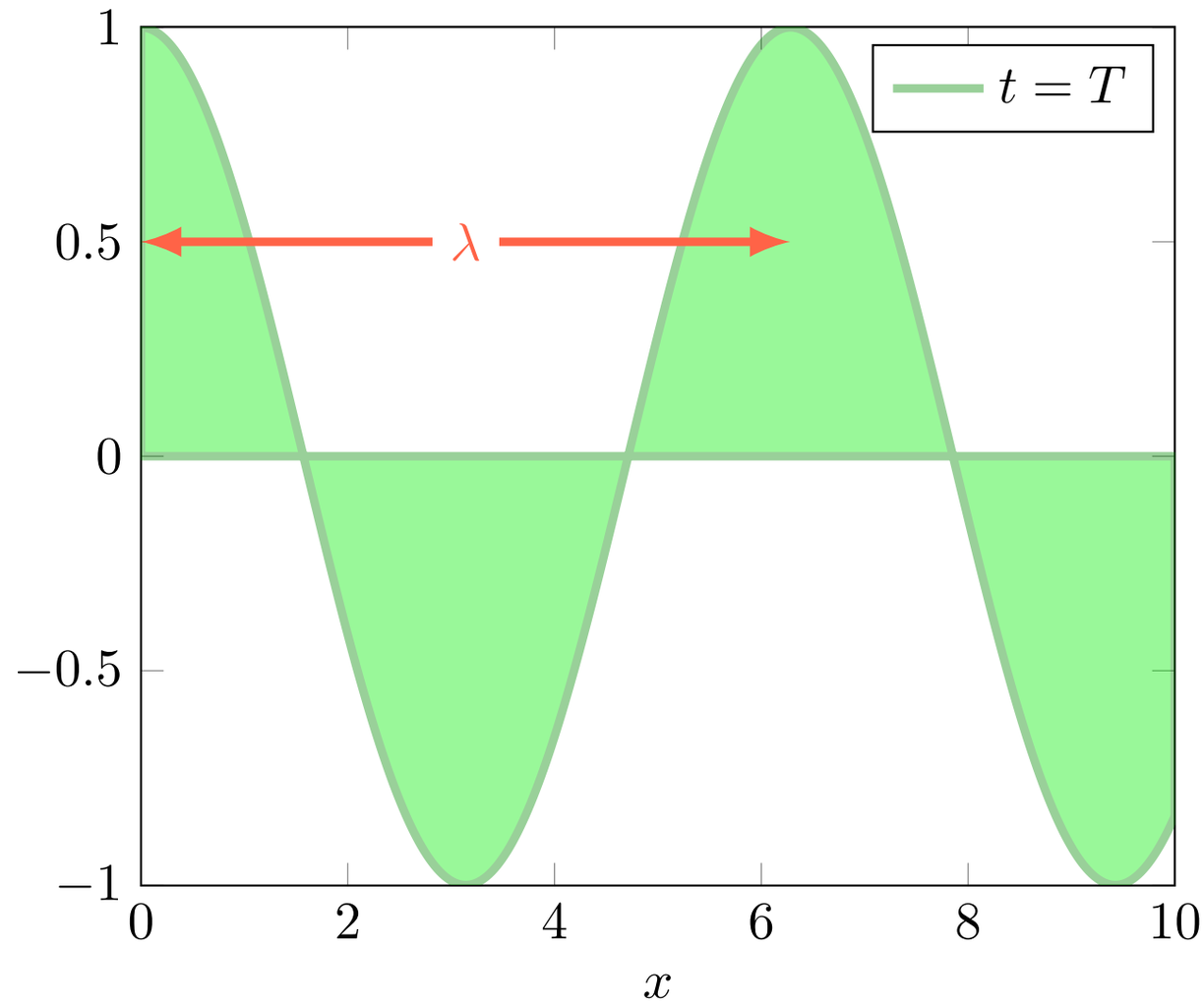

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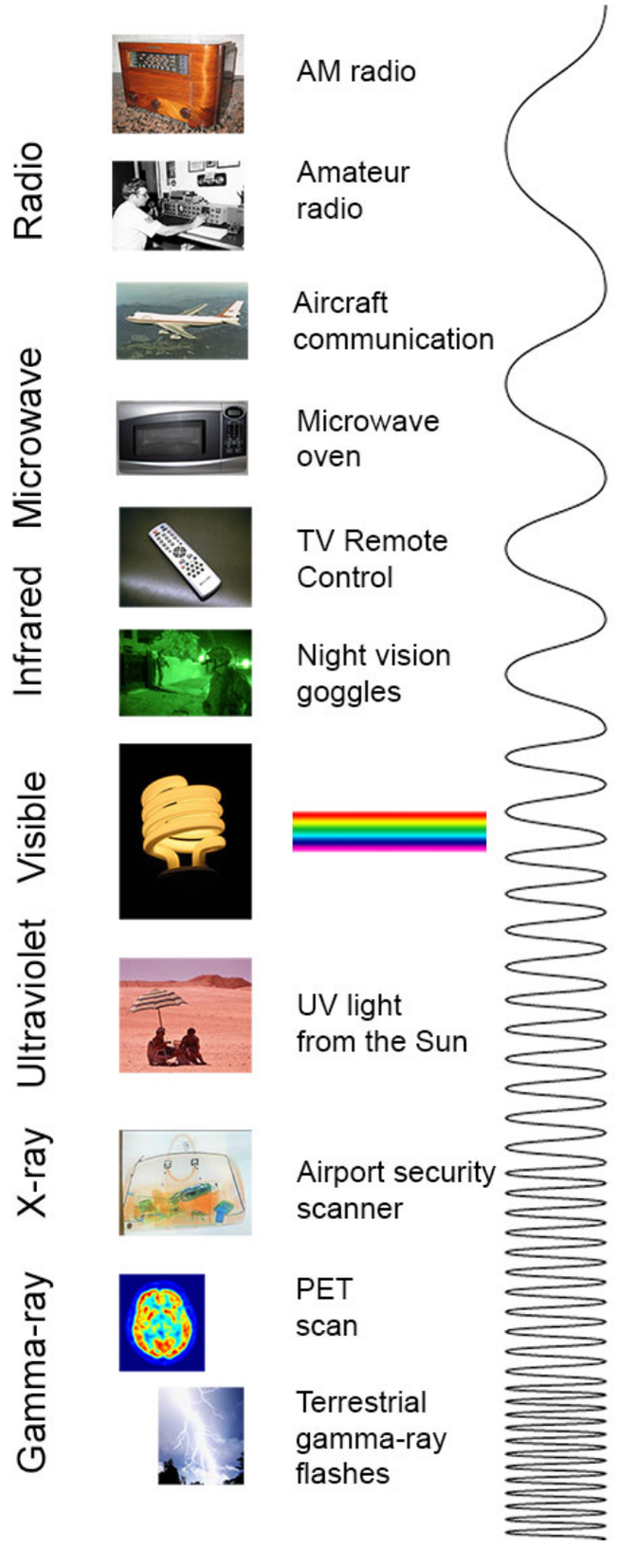

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$$\vec{E} = \vec{E}_0 e^{i(kz-\omega t)}$$

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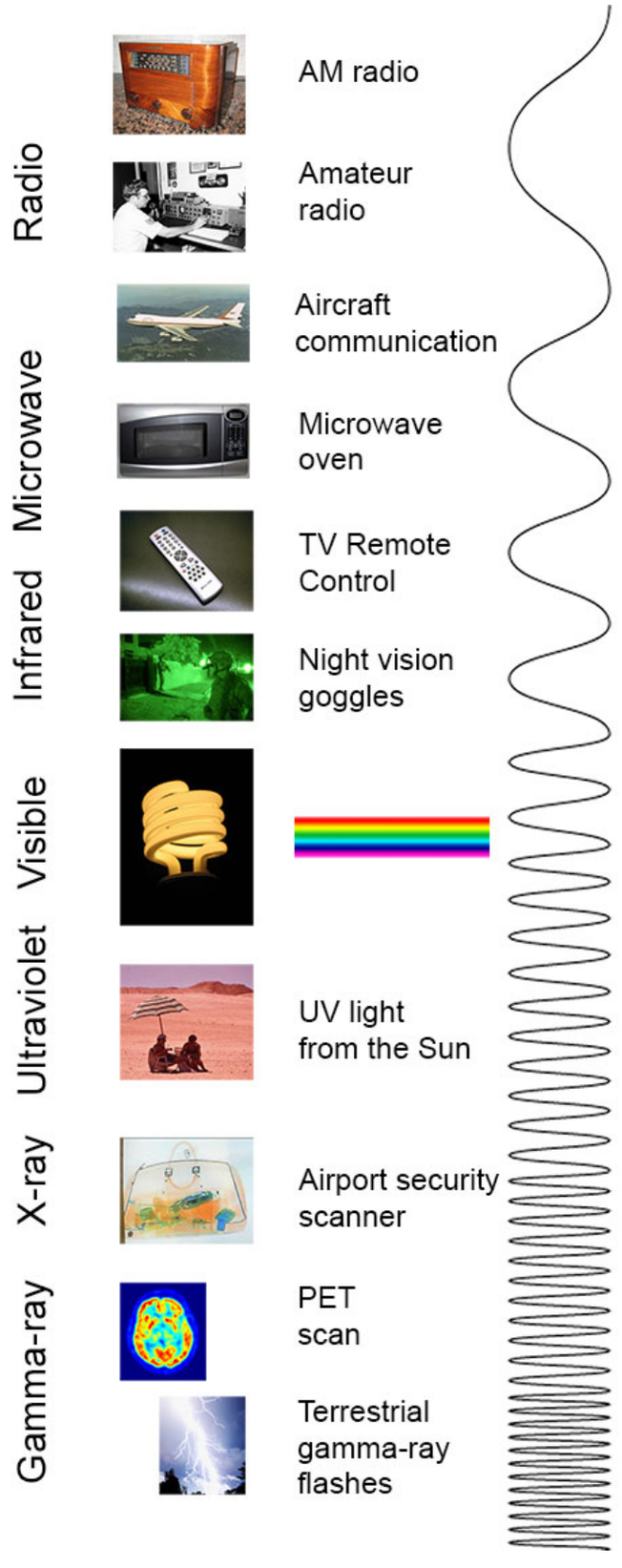
$$\vec{\nabla} \cdot \vec{\mathbf{E}} = 0$$



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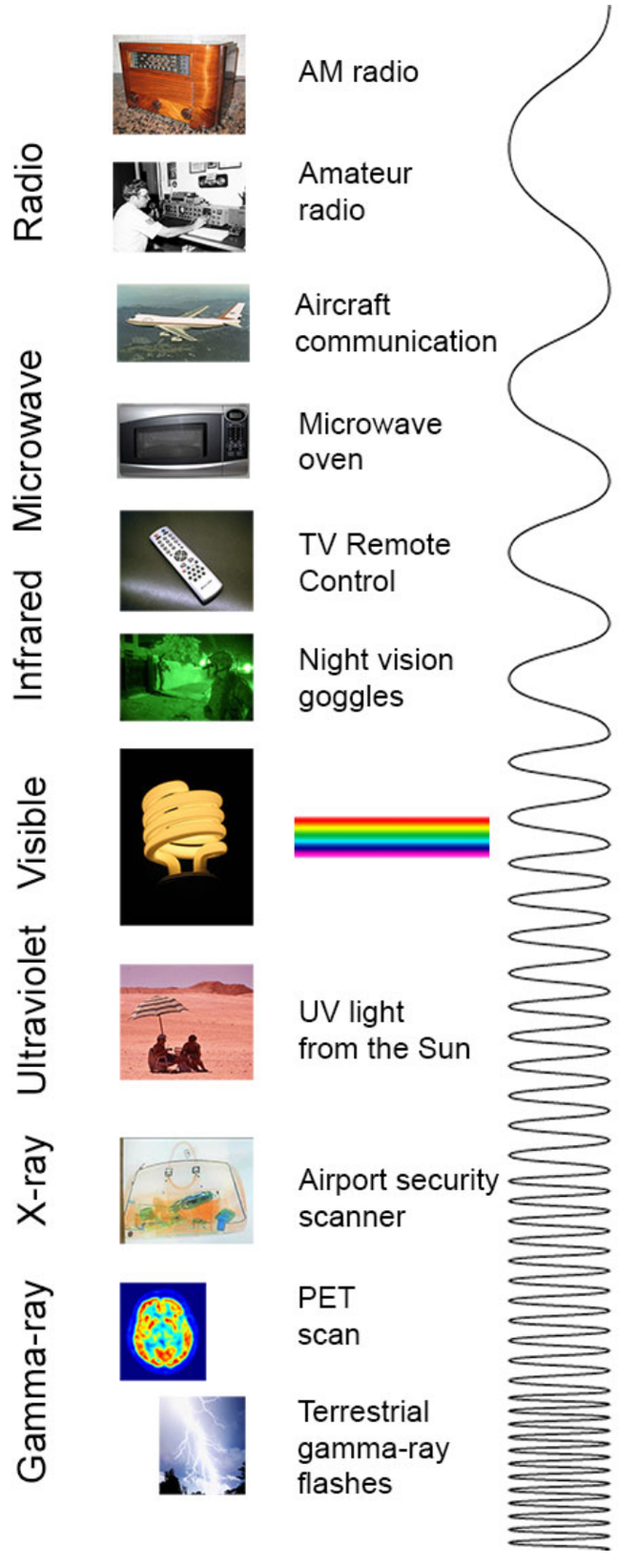

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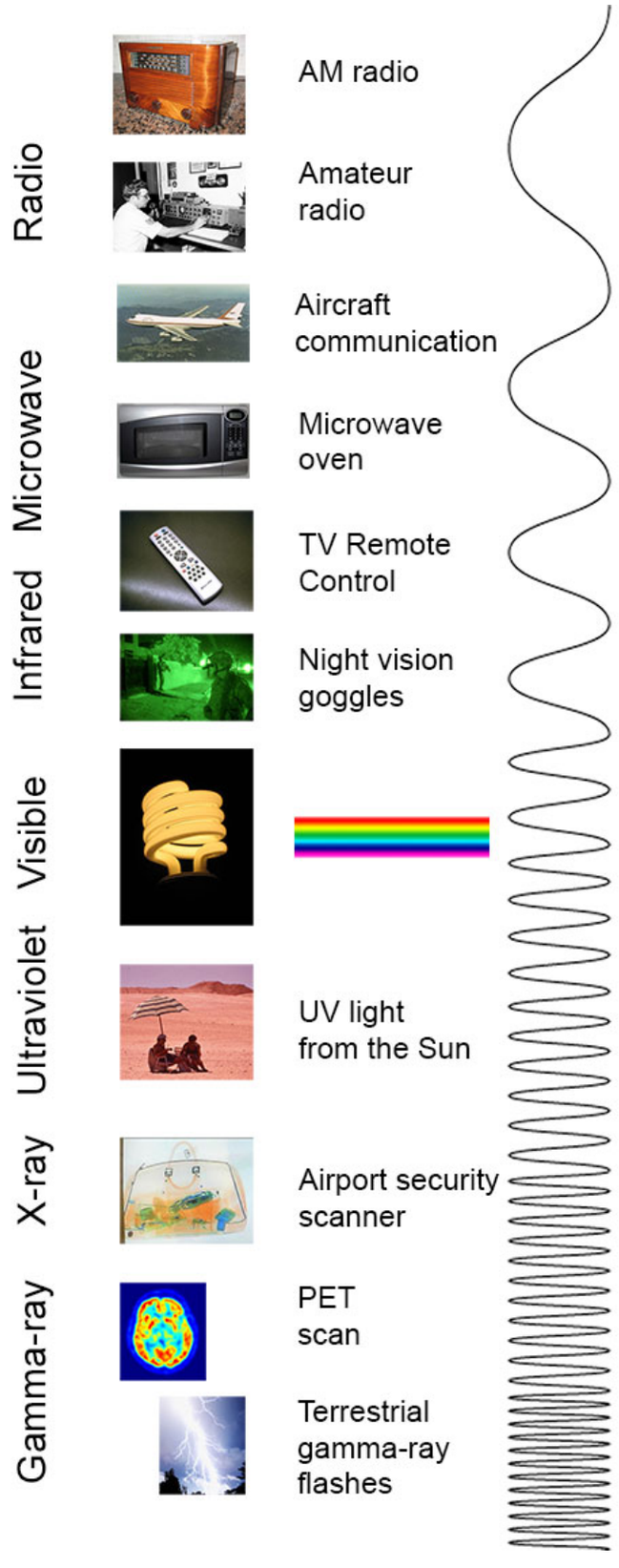
$$\vec{E}_0 = E_{0x}\hat{\mathbf{x}} + E_{0y}\hat{\mathbf{y}}$$



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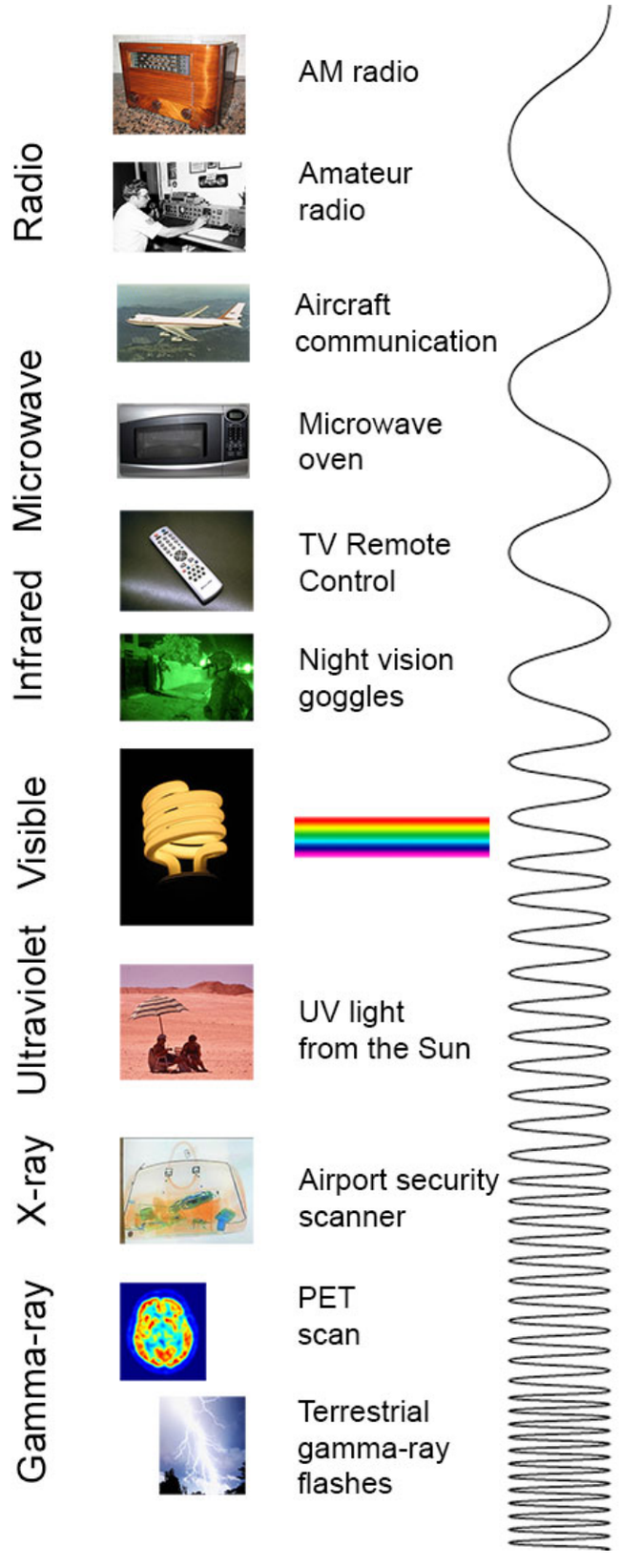

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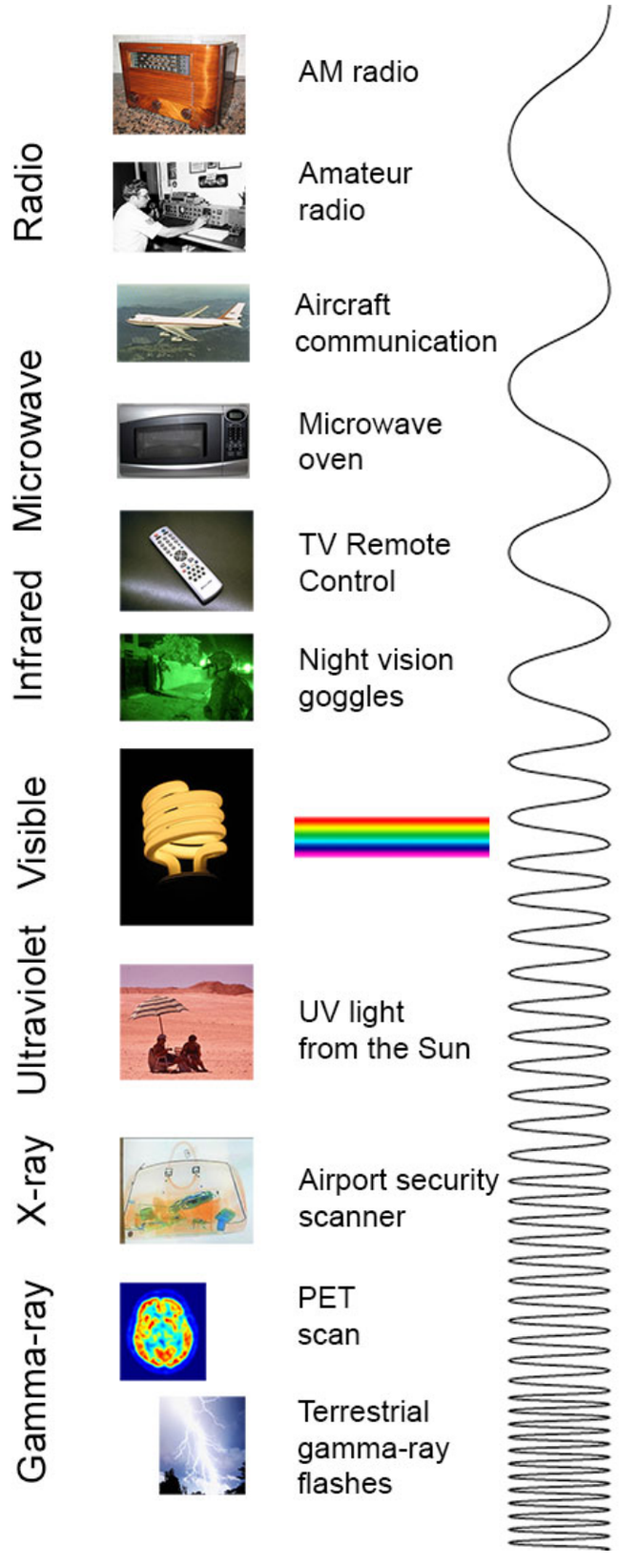
Em geral

$$\vec{\mathbf{E}} = \vec{\mathbf{E_0}} e^{i(\vec{\mathbf{k}}\cdot\vec{\mathbf{r}}-\omega t)}$$



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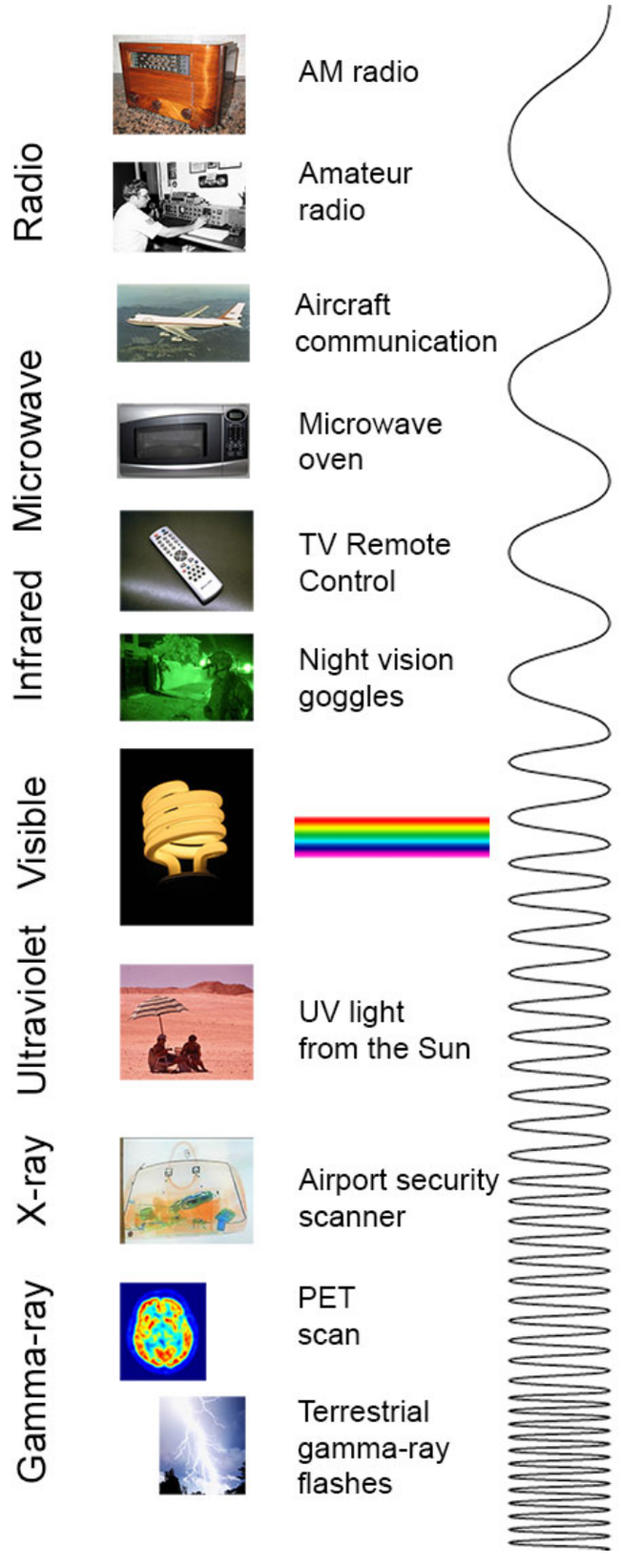

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$$\vec{E} = \vec{E}_0 e^{i(kz-\omega t)}$$

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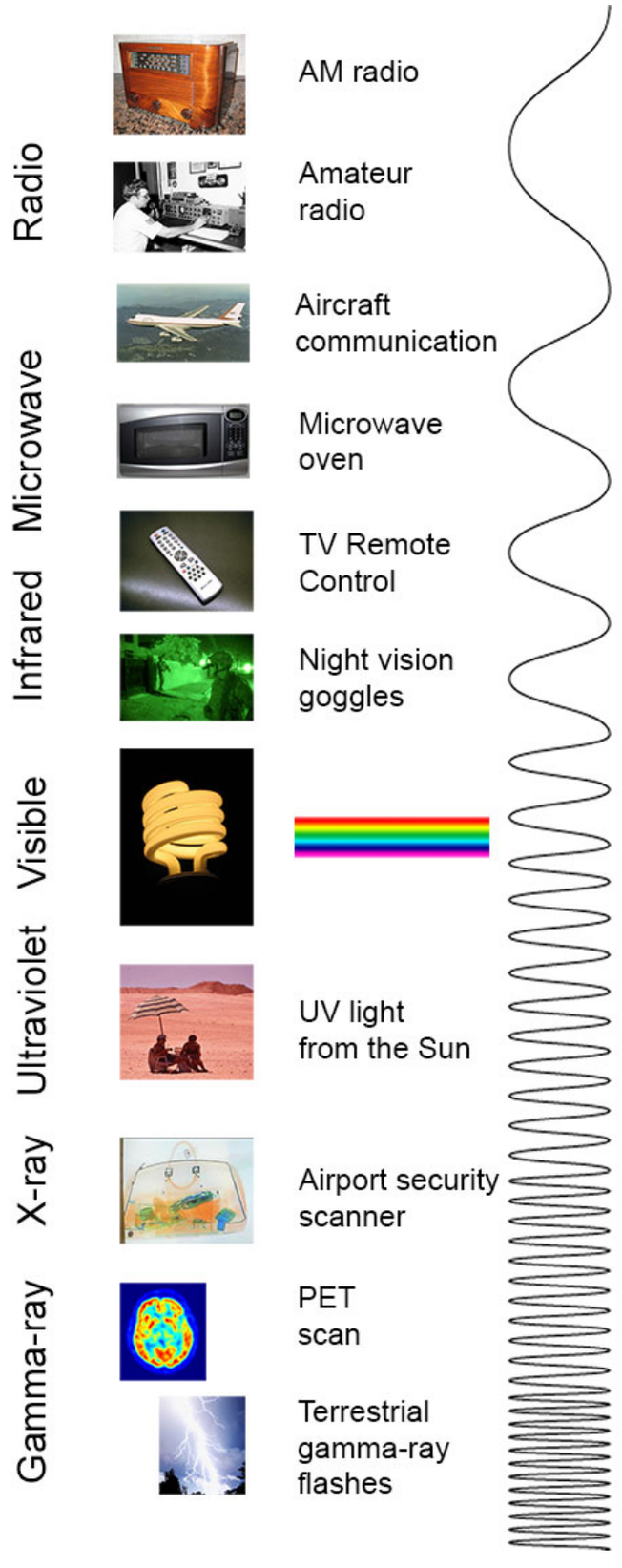
$$\vec{\nabla} \times \vec{\mathbf{E}} = -\frac{\partial \vec{\mathbf{B}}}{\partial t}$$



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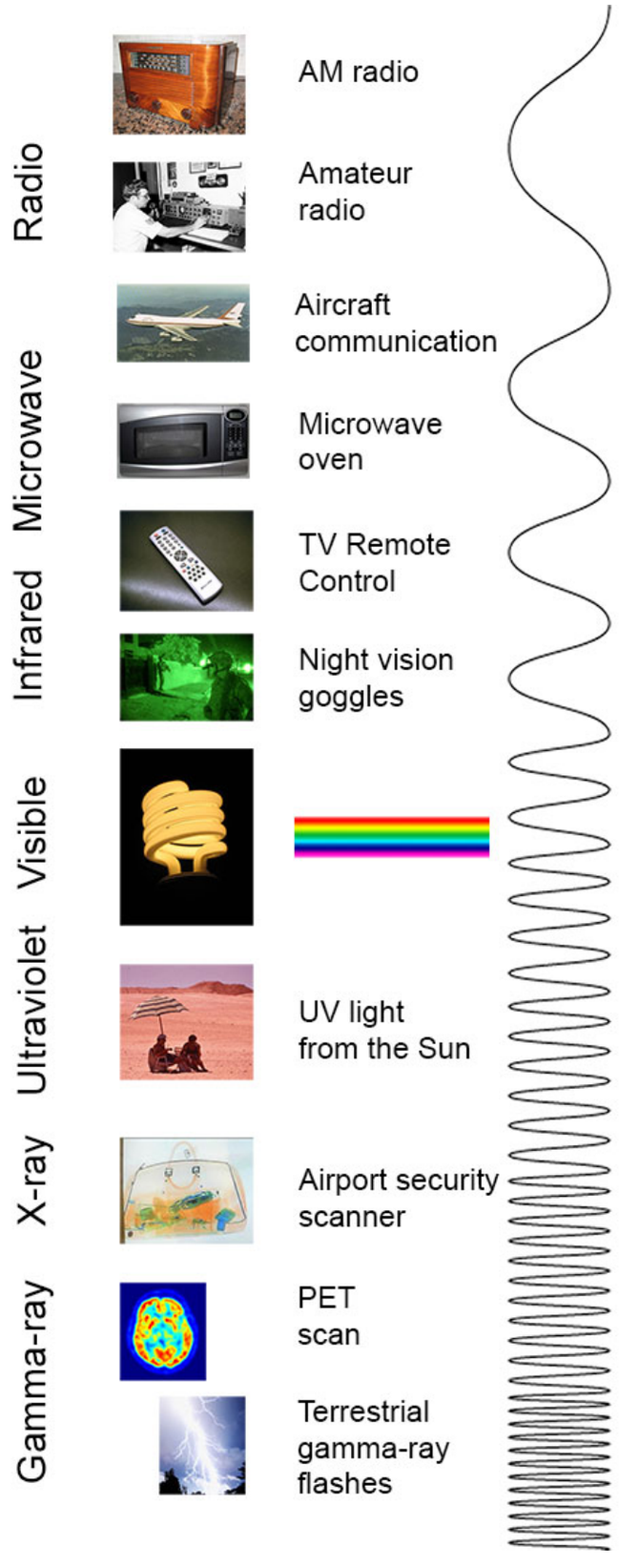
$$-\frac{\partial E_{0y}}{\partial z} = -\frac{\partial B_{0x}}{\partial t}$$



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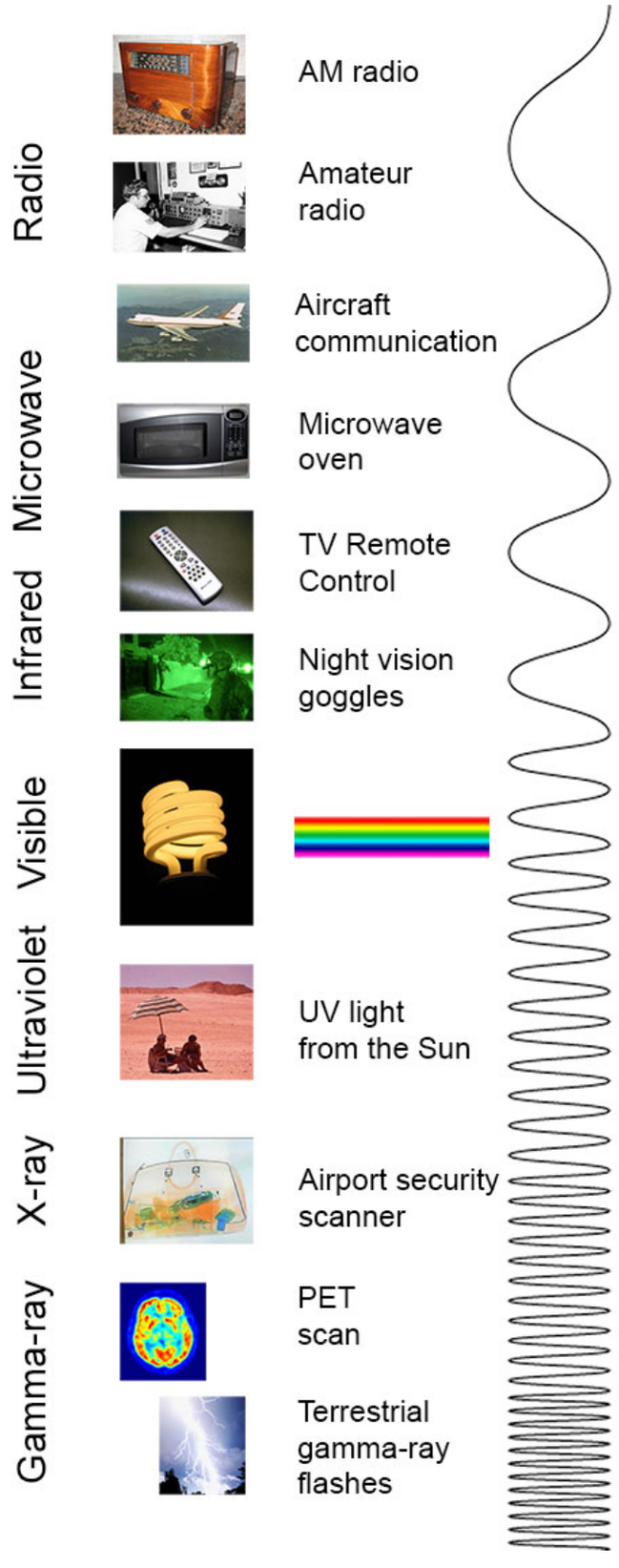

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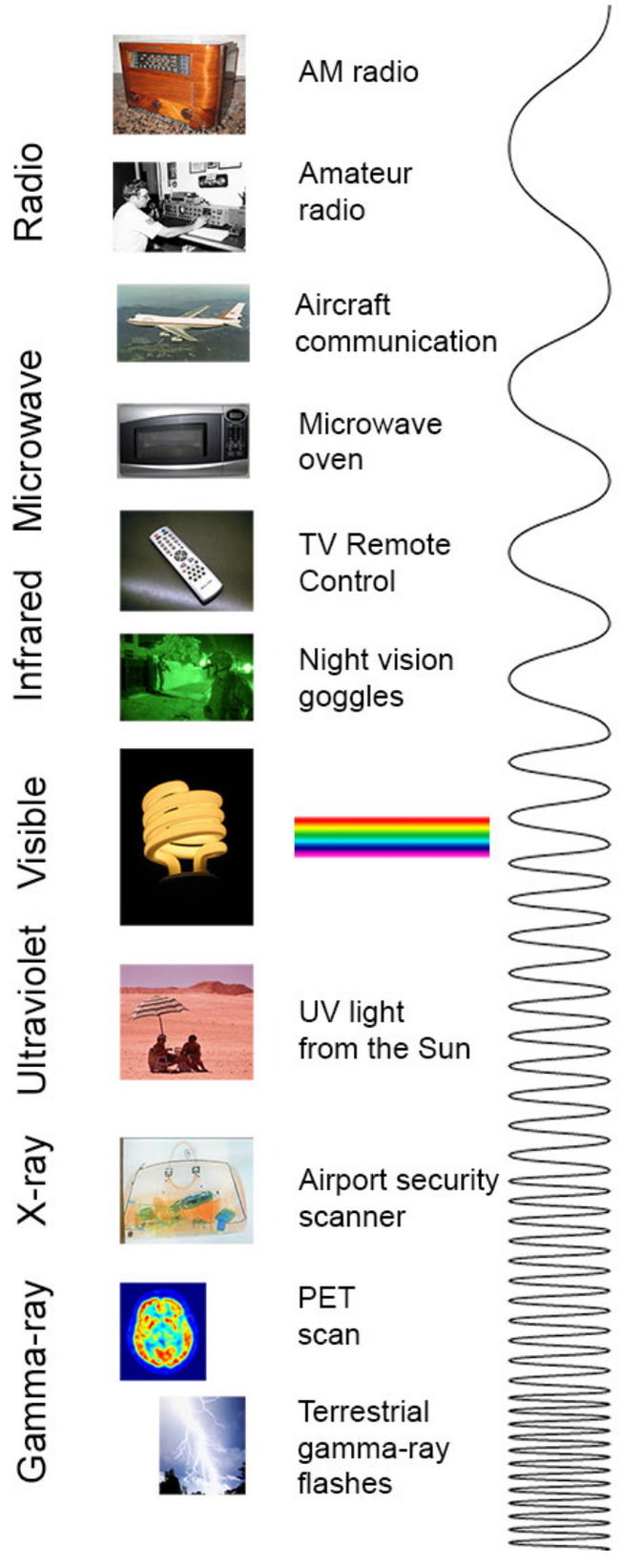
$$-\frac{\partial E_{0y}}{\partial z} = -\frac{\partial B_{0x}}{\partial t} \quad \Rightarrow \quad kE_{0x} = \omega B_{0y}$$

$$\frac{\partial E_{0x}}{\partial z} = -\frac{\partial B_{0y}}{\partial t}$$



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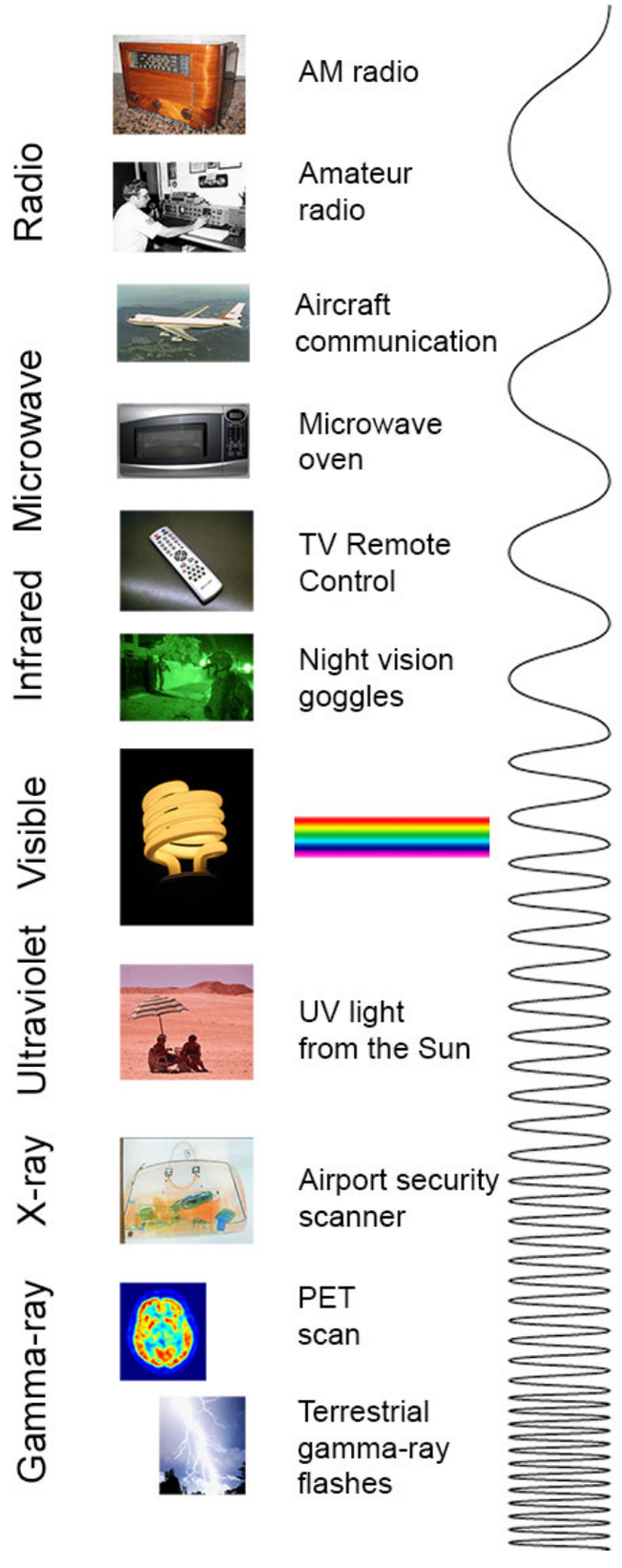

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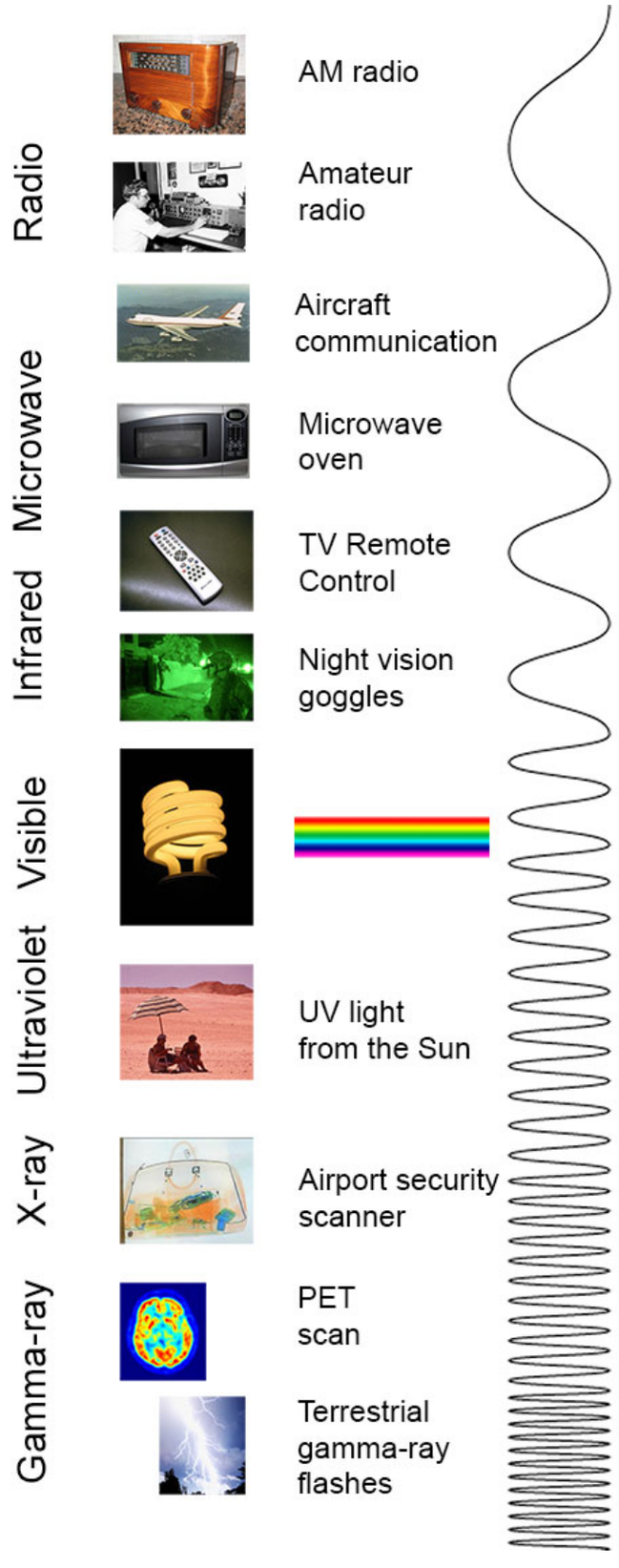
$$\vec{\mathbf{B}}_0 = \frac{k}{\omega}\hat{\mathbf{z}} \times \vec{\mathbf{E}}_0$$



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Em geral

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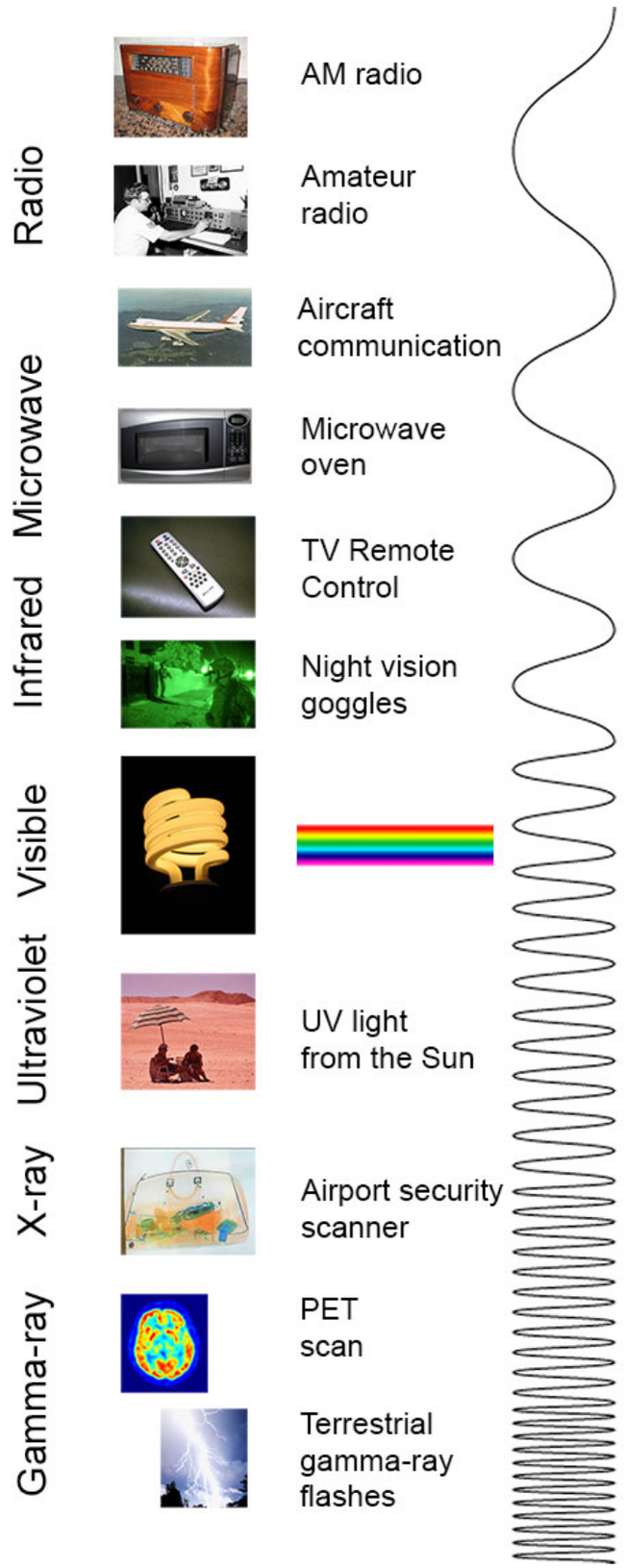

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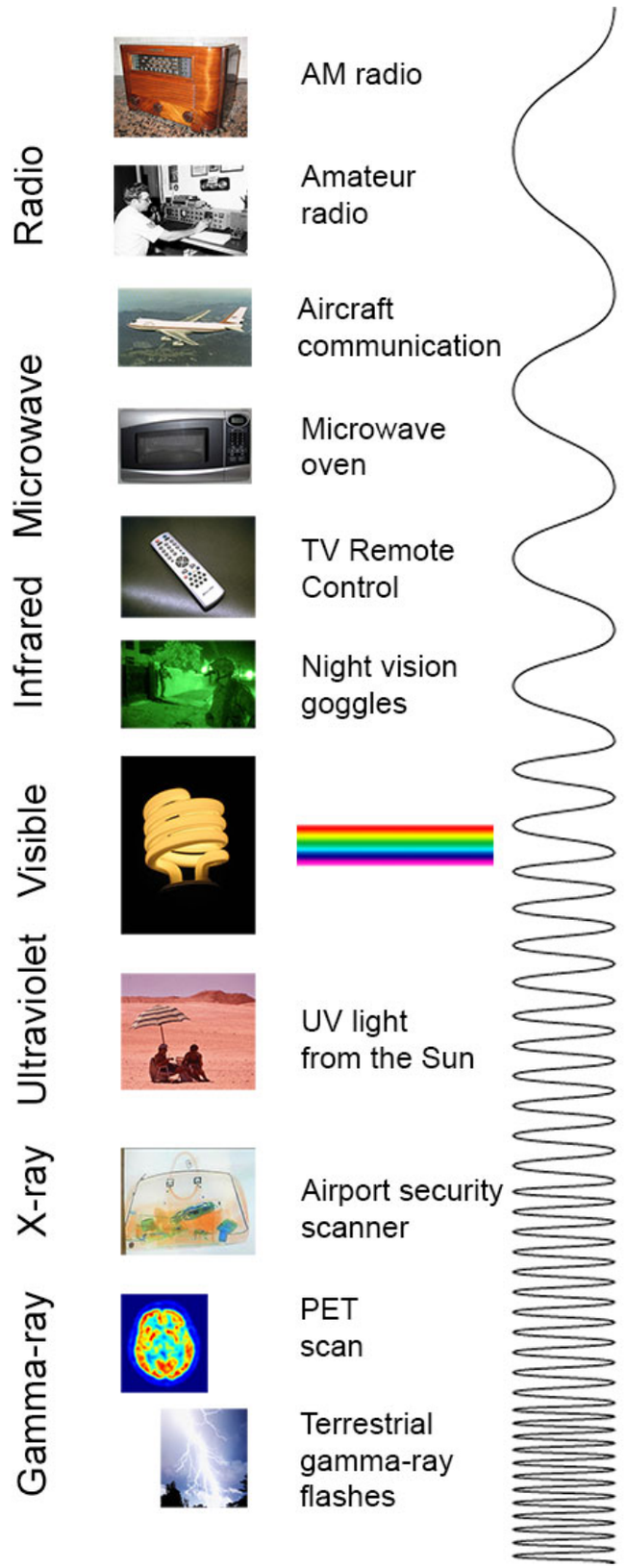

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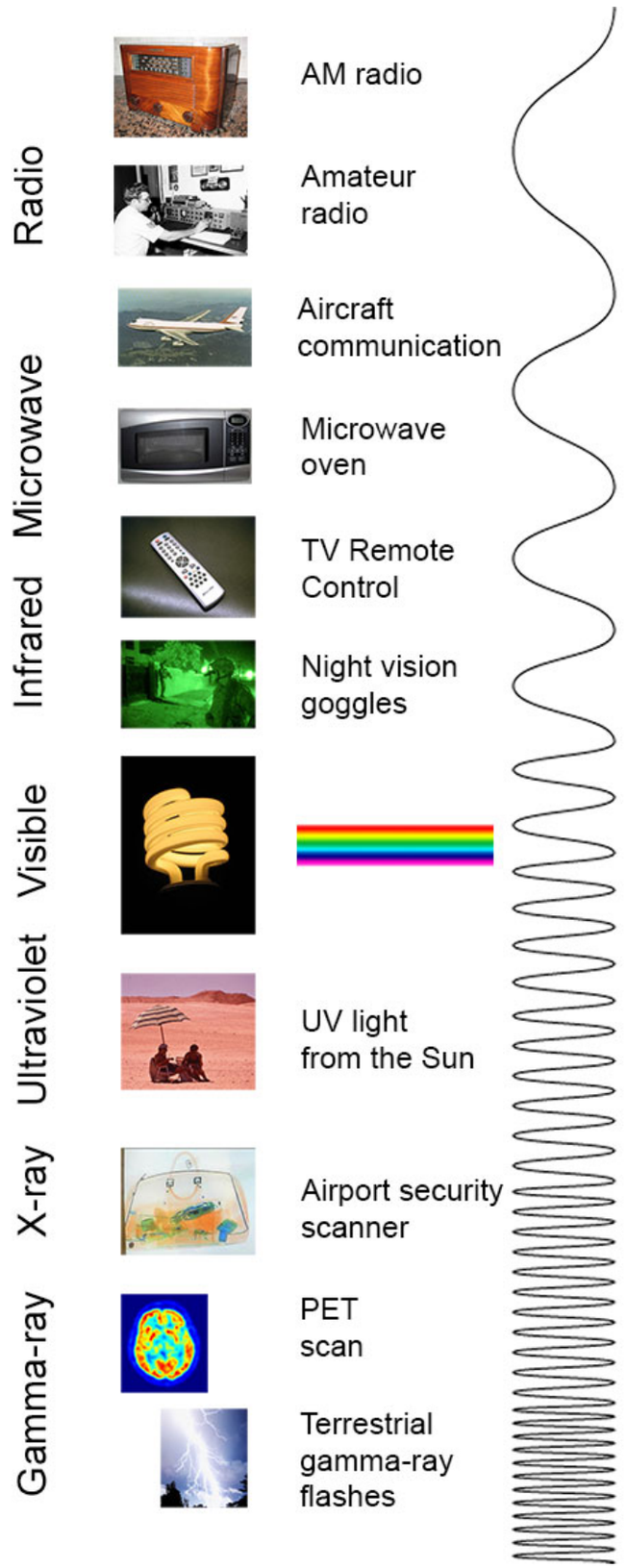
$$\vec{\mathbf{B}} = \frac{1}{c}\hat{\mathbf{k}} \times \vec{\mathbf{E}}$$



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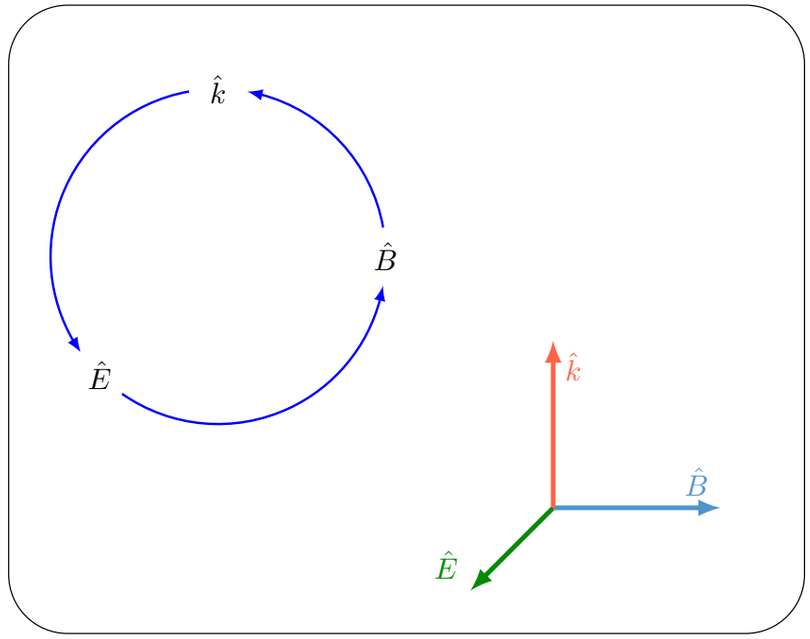

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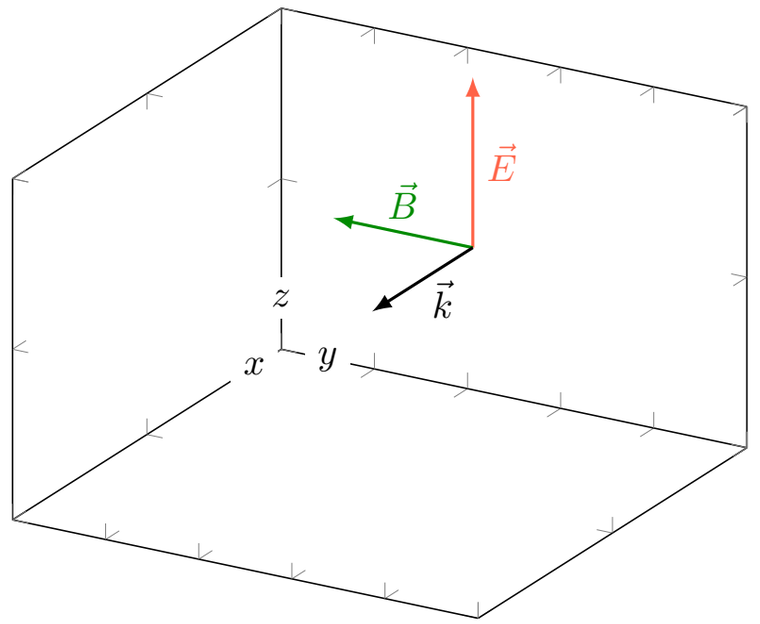

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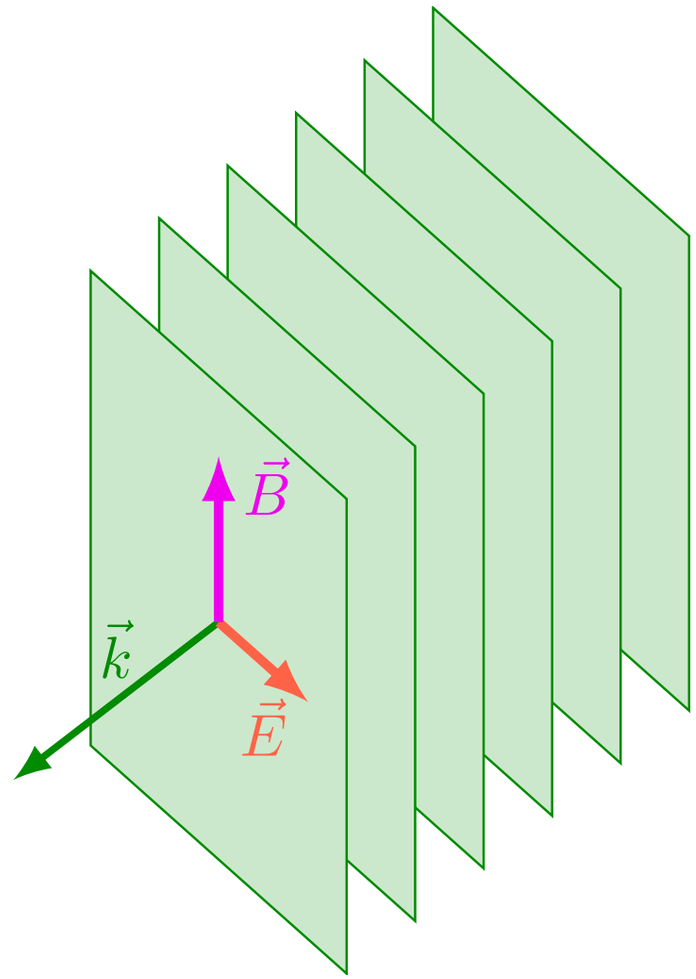

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