

Eletromagnetismo

20 de junho
Magnetismo

Potencial vetor

$$\vec{\nabla} \cdot \vec{B} = 0$$

$$\vec{\nabla} \times \vec{B} = \mu_0 \vec{J}$$

$$\vec{B} = \vec{\nabla} \times \vec{A}$$

$$\vec{\nabla} \times (\vec{\nabla} \times \vec{A}) = \mu_0 \vec{J}$$

$$\vec{\nabla} (\vec{\nabla} \cdot \vec{A}) - \nabla^2 \vec{A} = \mu_0 \vec{J}$$

$$\vec{\nabla} \cdot \vec{A} = 0$$

$$\nabla^2 \vec{A} = -\mu_0 \vec{J}$$

Análoga a

$$\nabla^2 \vec{V} = -\frac{\rho}{\epsilon_0}$$

Potencial vetor

$$\vec{\nabla} \cdot \vec{B} = 0$$

$$\vec{B} = \vec{\nabla} \times \vec{A}$$

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Análoga a

$$\nabla^2 \vec{V} = -\frac{\rho}{\epsilon_0}$$

Potencial vector

$$\nabla^2 \vec{V} = -\frac{\rho}{\epsilon_0}$$



$$\vec{V}(\vec{r}) = \frac{1}{4\pi\epsilon_0} \int \frac{\rho(\vec{r}')}{r} d\tau'$$

$$\nabla^2 \vec{A} = -\mu_0 \vec{J}$$



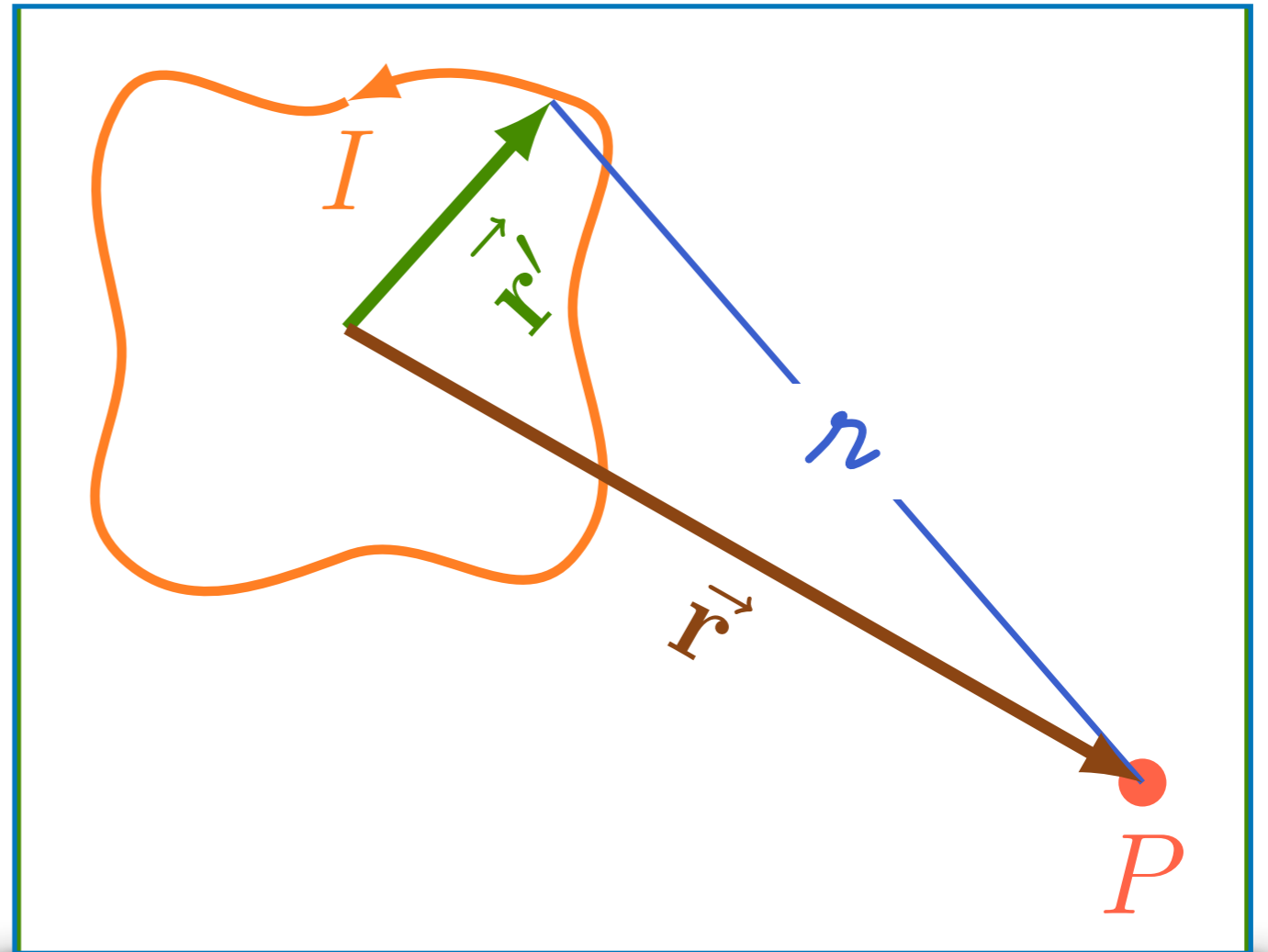
$$\vec{A}(\vec{r}) = \frac{\mu_0}{4\pi} \int \frac{\vec{J}(\vec{r}')}{r} d\tau'$$

Potencial vector

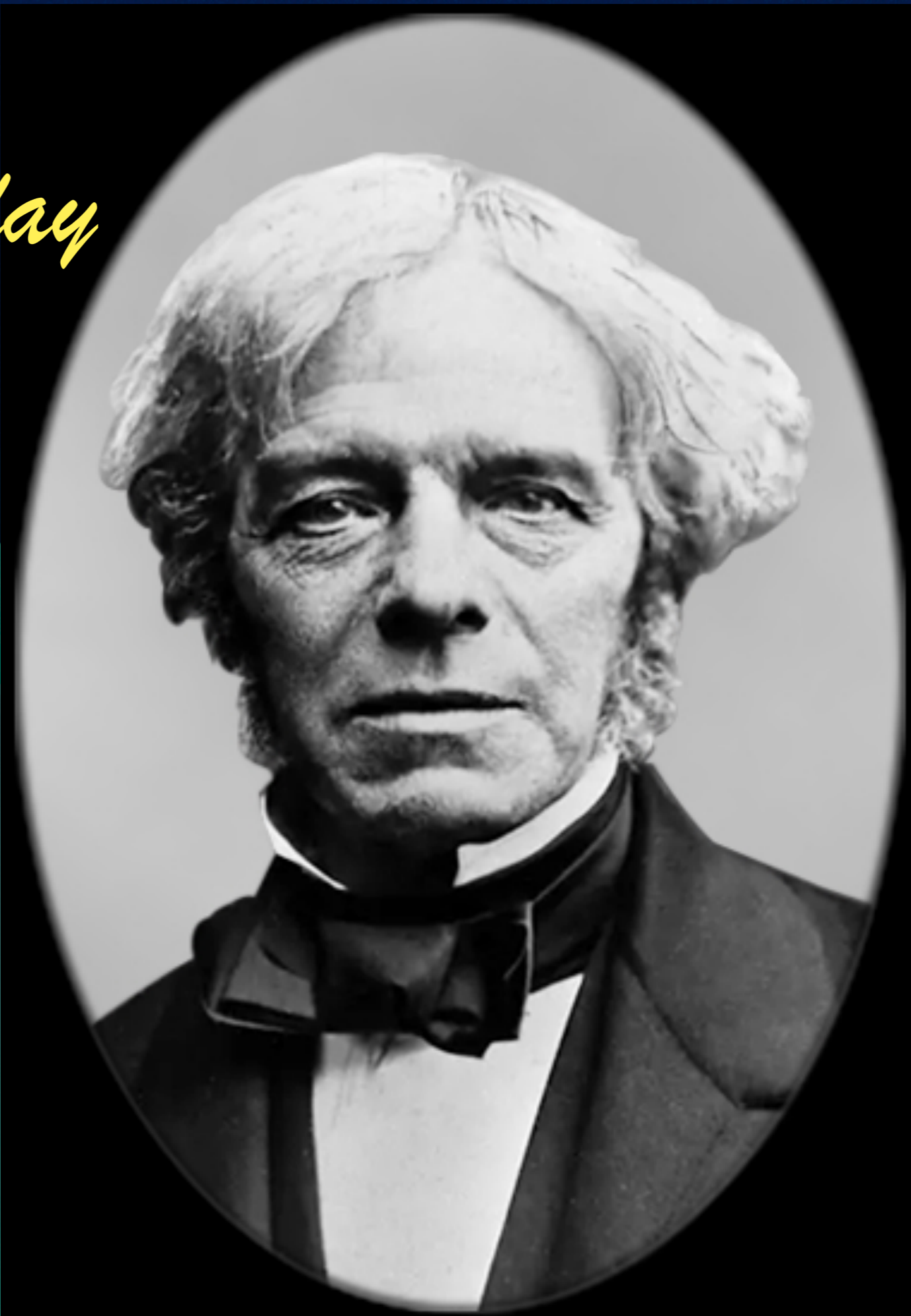
$$\nabla^2 \vec{A} = -\mu_0 \vec{J}$$

$$\vec{A}(\vec{r}) = \frac{\mu_0}{4\pi} \int \frac{\vec{J}(\vec{r}')}{r} d\tau'$$

$$\vec{A}(\vec{r}) = \frac{\mu_0 I}{4\pi} \int \frac{d\vec{\ell}'}{r}$$

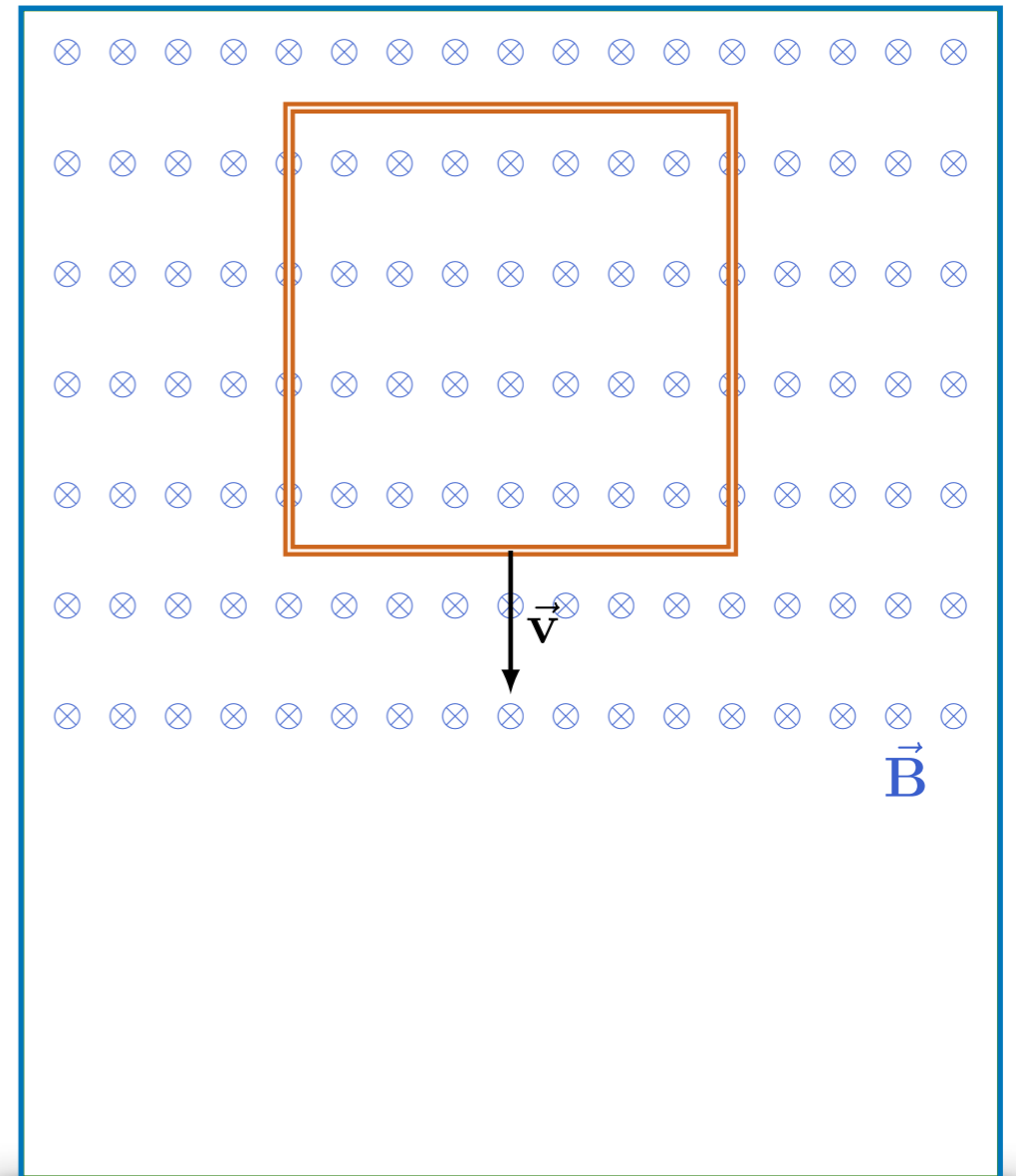


Lei de Faraday



Circuito elétrico em campo magnético

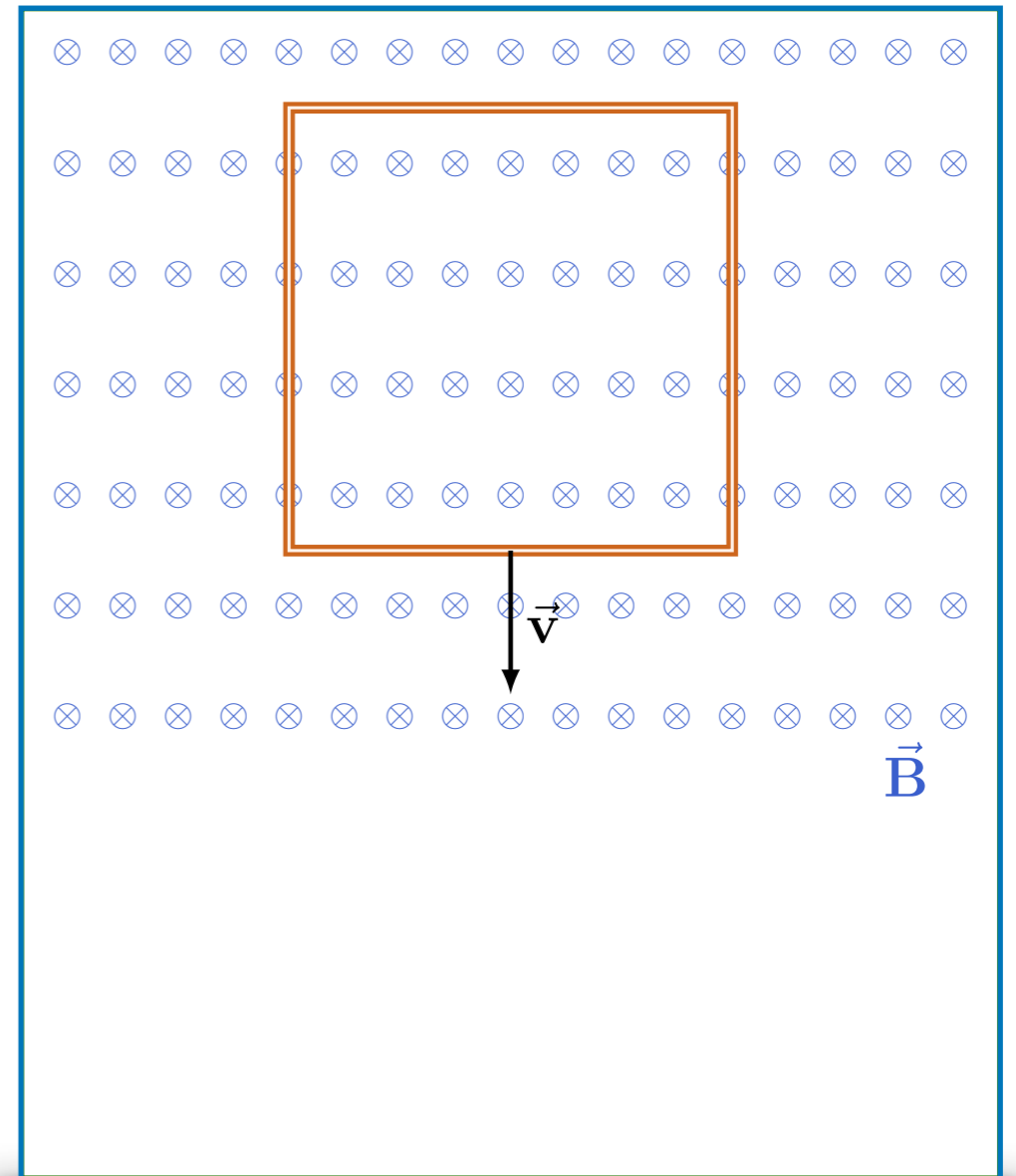
$$\vec{F} = q\vec{v} \times \vec{B}$$



Circuito elétrico em campo magnético

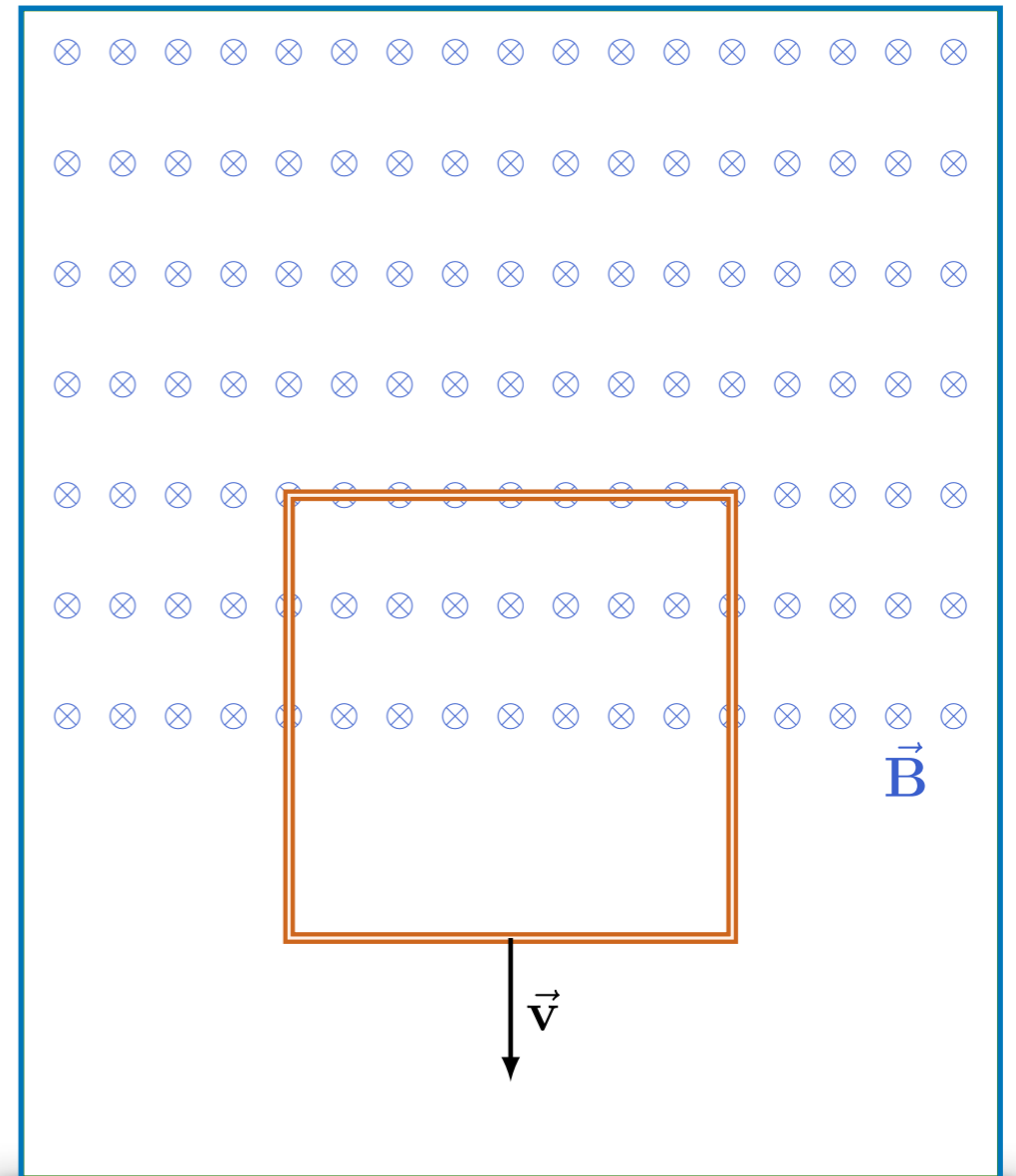
$$\vec{F} = q\vec{v} \times \vec{B}$$

$$I = 0 \quad \text{😞}$$



Circuito elétrico em campo magnético

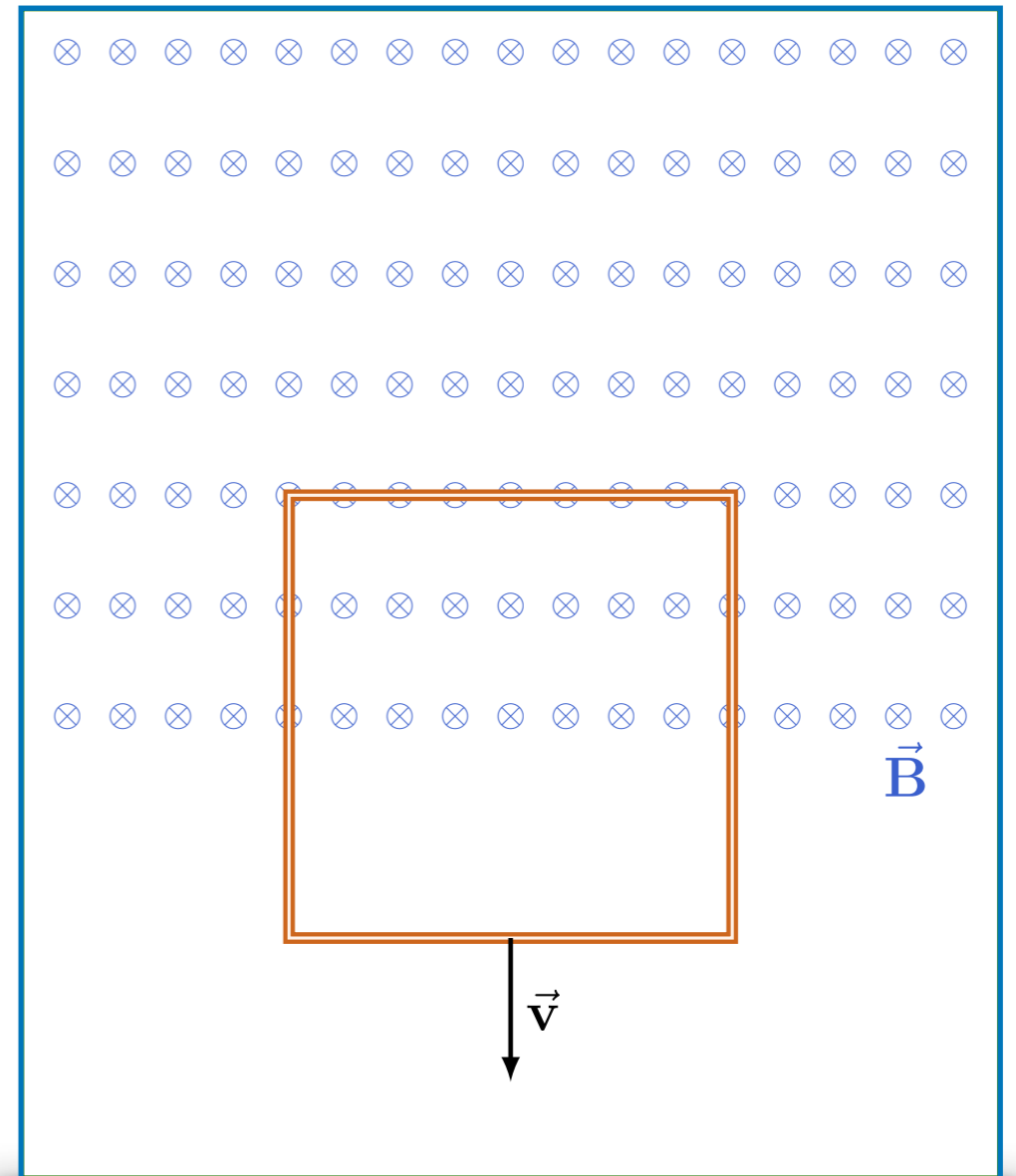
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Circuito elétrico em campo magnético

$$\vec{F} = q\vec{v} \times \vec{B}$$

$$I \neq 0 \quad \text{😊}$$

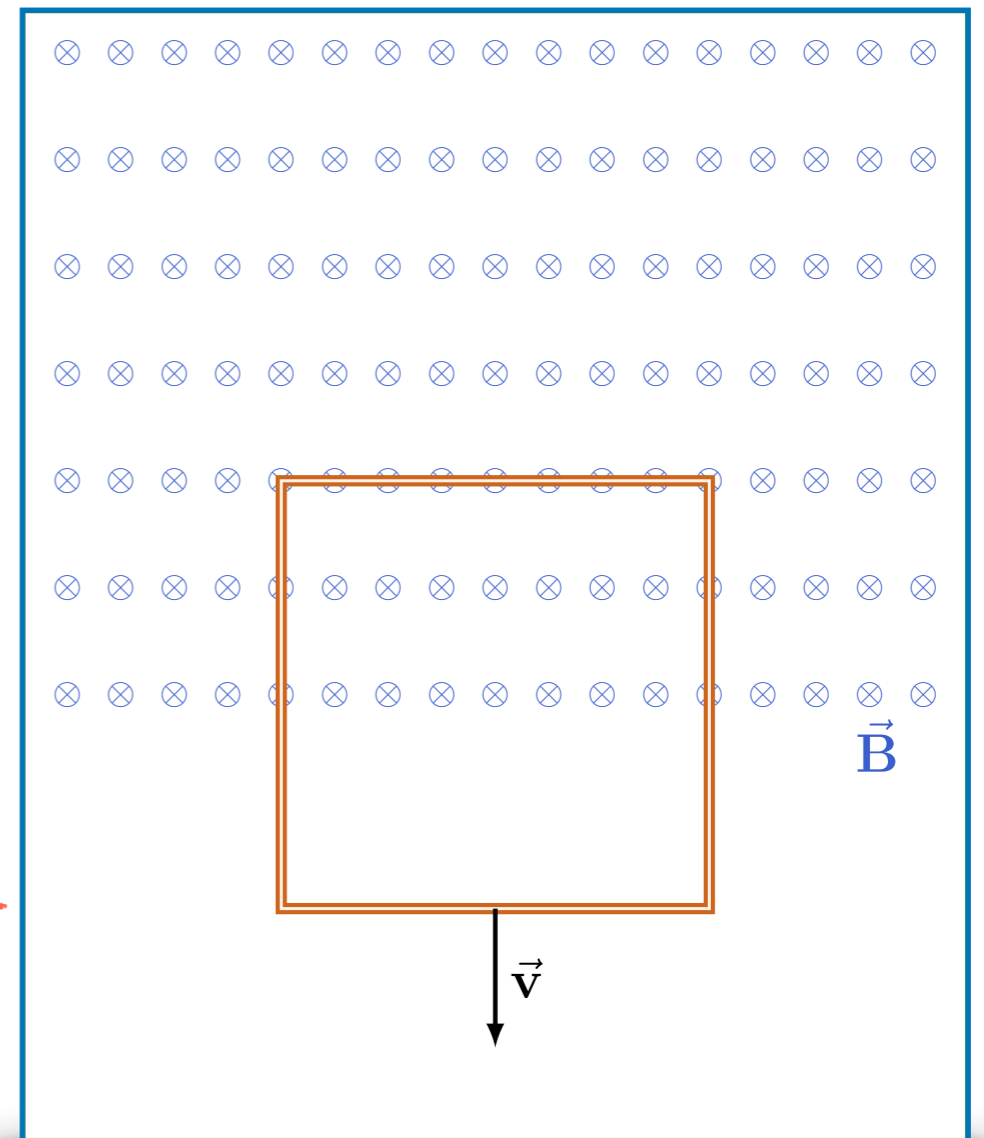


Circuito elétrico em campo magnético

$$\vec{F} = q\vec{v} \times \vec{B}$$

$$I \neq 0 \quad \text{😊}$$

$$\oint \vec{v} \times \vec{B} \cdot d\vec{\ell} \equiv \mathcal{E} \text{ Força eletromotriz}$$



$$\mathcal{E} = \int \vec{E} \cdot d\vec{\ell}$$

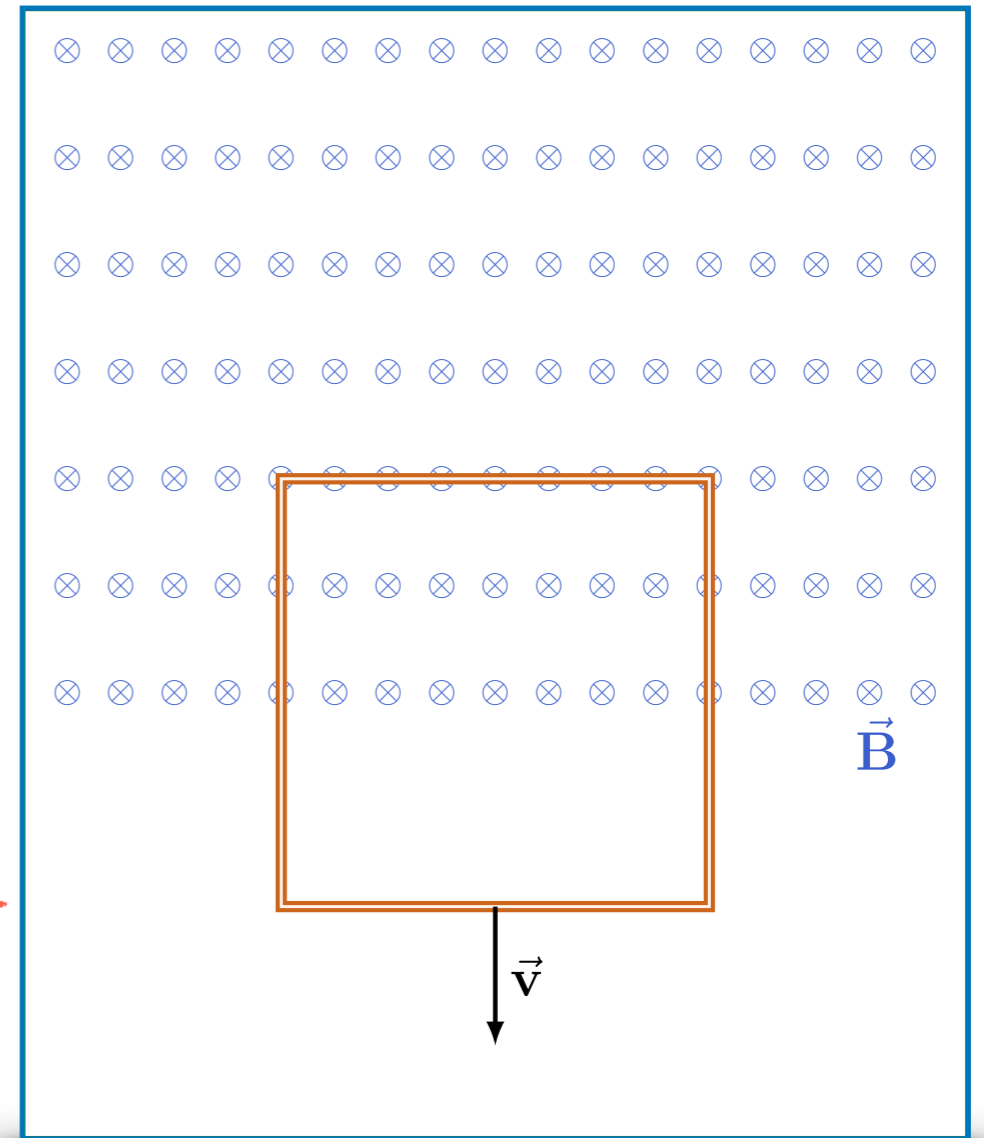
Circuito elétrico em campo magnético

$$\vec{F} = q\vec{v} \times \vec{B}$$

$$I \neq 0 \quad 😊$$

$$\oint \vec{v} \times \vec{B} \cdot d\vec{\ell} \equiv \mathcal{E} \text{ Força eletromotriz}$$

Análogo a ...



$$\mathcal{E} = \int \vec{E} \cdot d\vec{\ell}$$

Circuito elé

$$\vec{F} = q\vec{v} \times \vec{B}$$

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Análogo a ...

$$\mathcal{E} = \int \vec{E} \cdot d\vec{\ell}$$

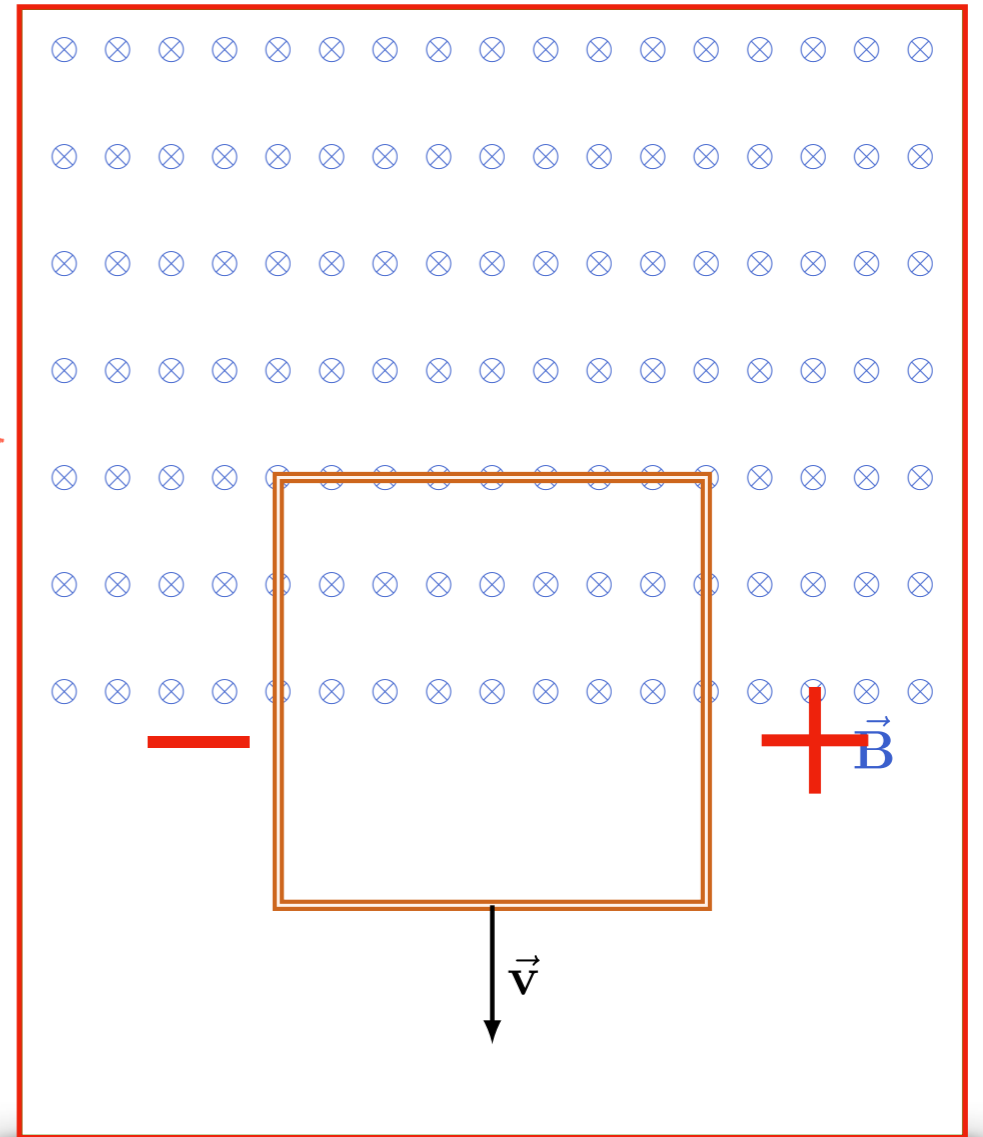
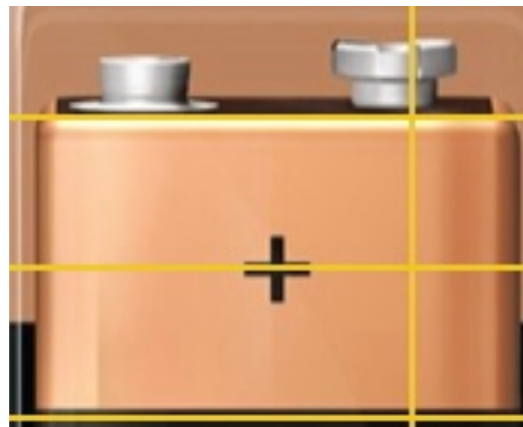


Circuito elétrico em campo magnético

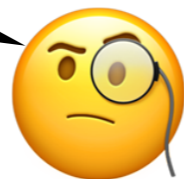
$$\vec{F} = q\vec{v} \times \vec{B}$$

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Análoga a

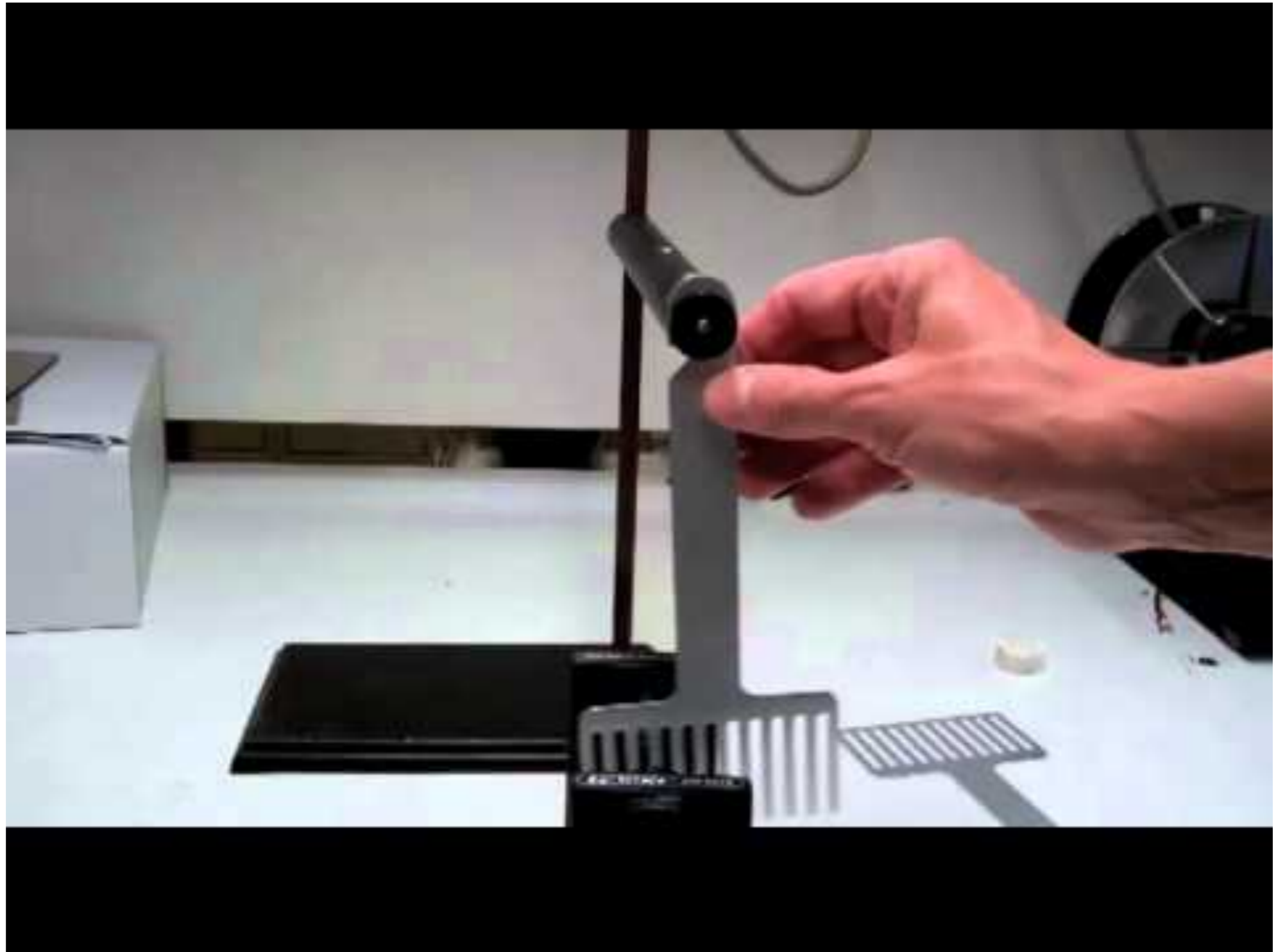


De onde vem a energia?



$$\mathcal{E} = \int \vec{E} \cdot d\vec{\ell}$$

Circuito elétrico em campo magnético



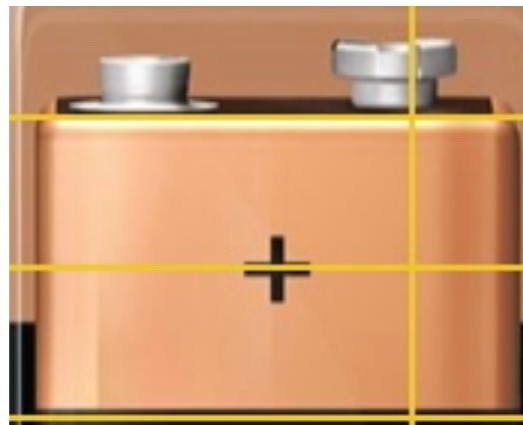
<https://www.youtube.com/watch?v=MgLUiIBy2LQ>

Circuito elétrico em campo magnético

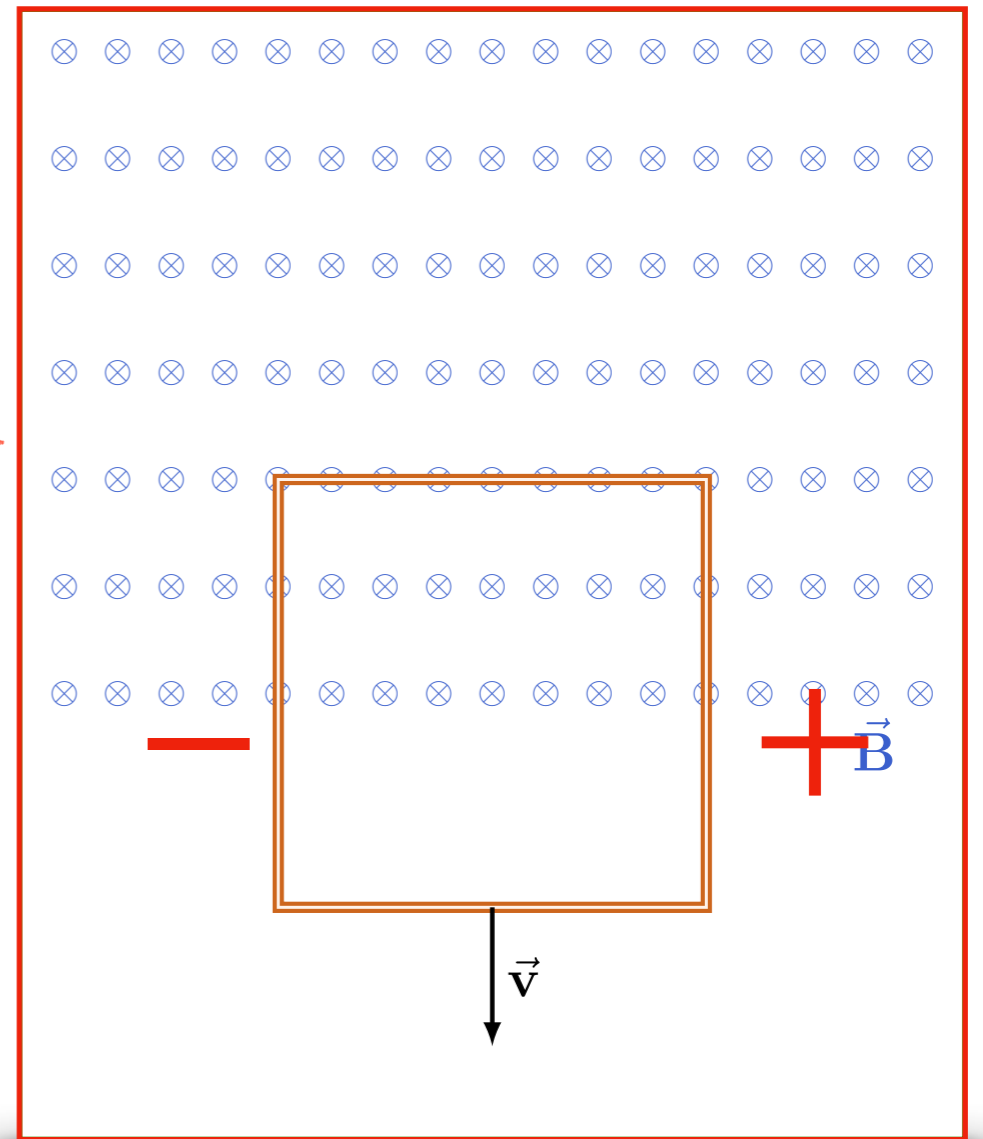
$$\vec{F} = q\vec{v} \times \vec{B}$$

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Análoga a

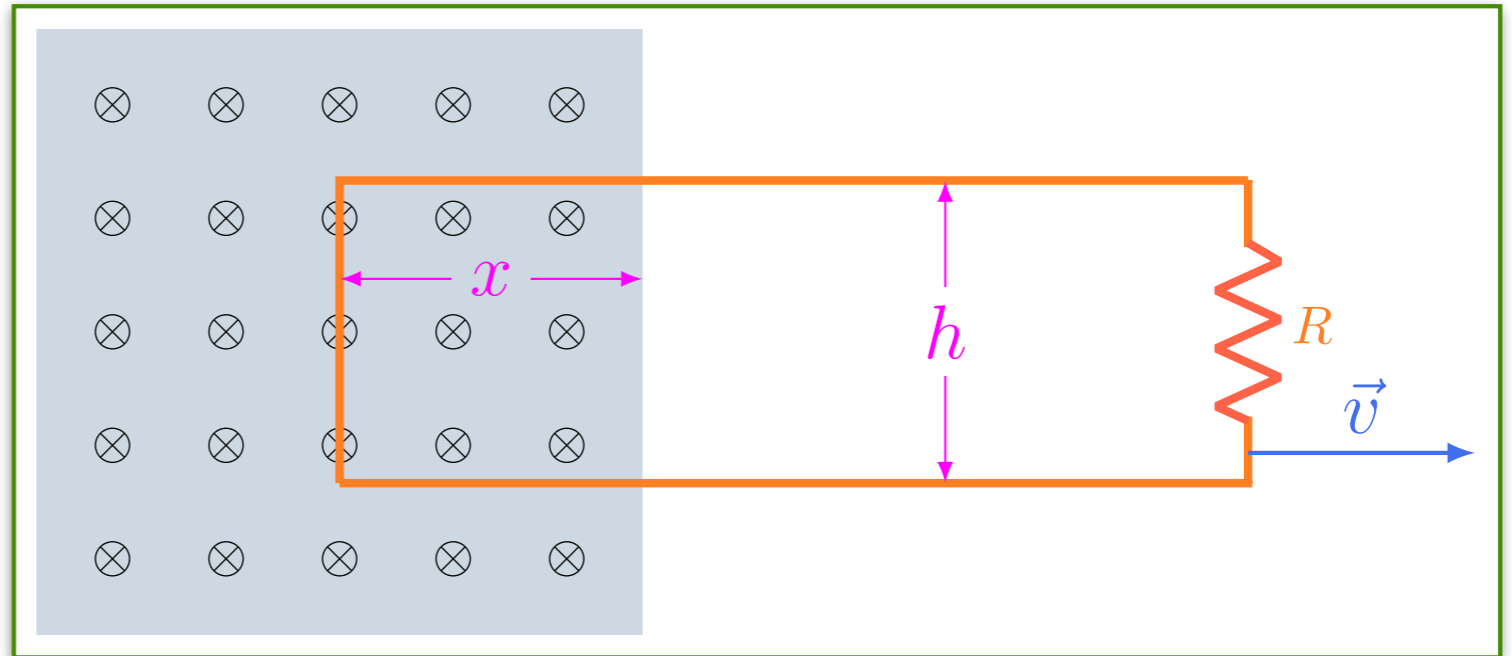


$$\mathcal{E} = \int \vec{E} \cdot d\vec{\ell}$$



Lei de Faraday

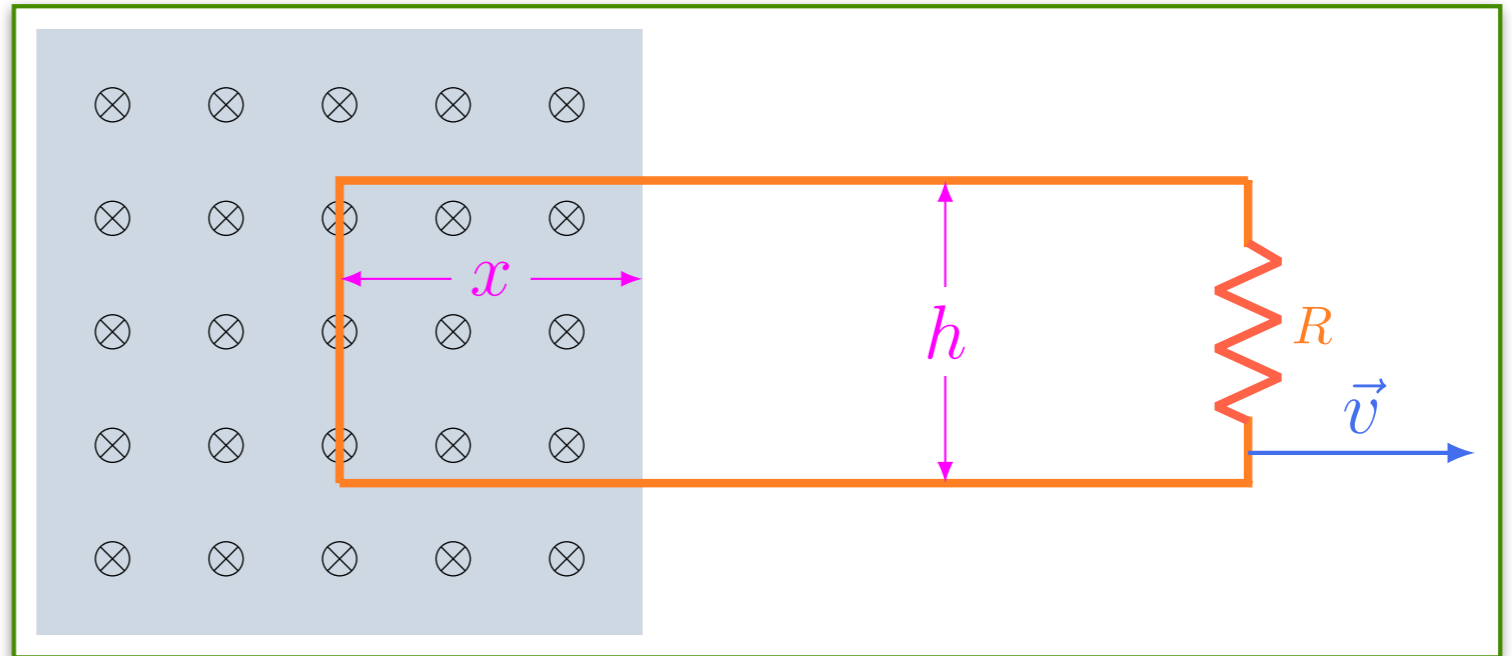
$$\oint \vec{v} \times \vec{B} \cdot d\vec{\ell} \equiv \mathcal{E}$$



Lei de Faraday

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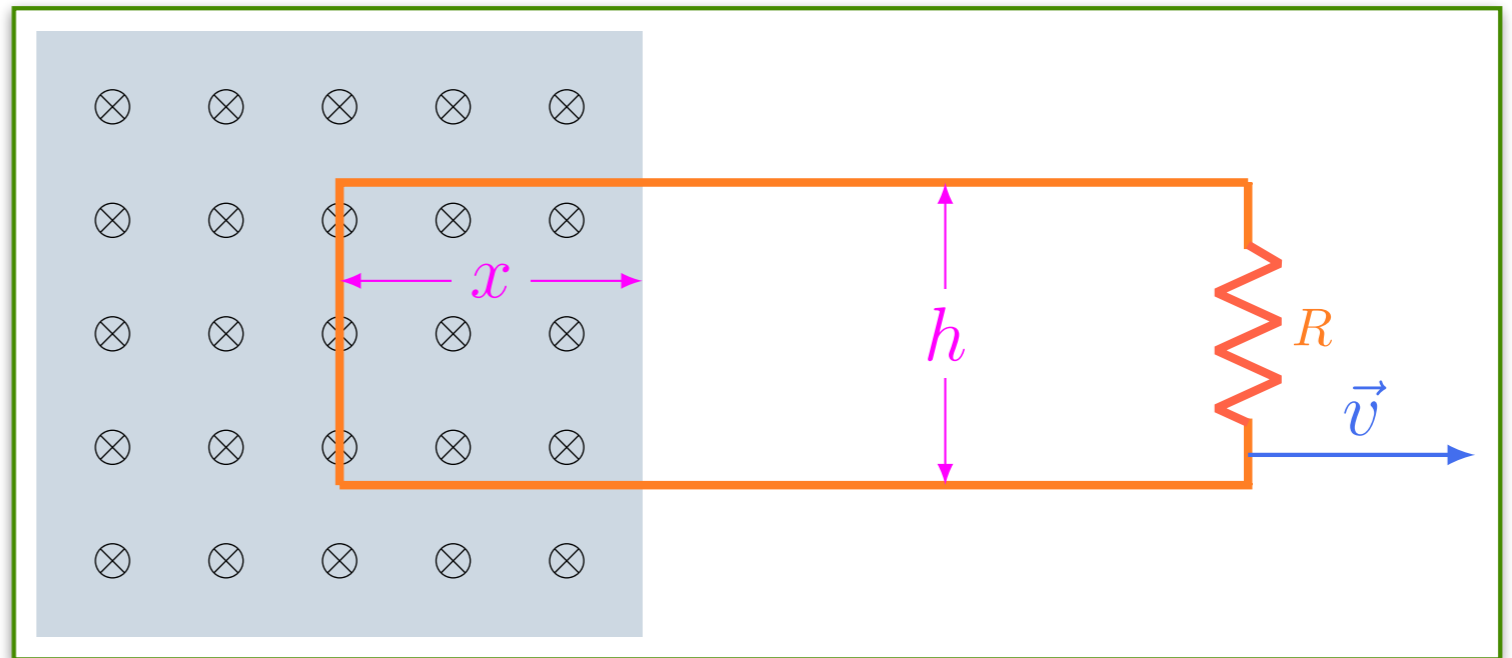
$$\mathcal{E} = vBh$$



Lei de Faraday

$$\oint \vec{v} \times \vec{B} \cdot d\vec{\ell} \equiv \mathcal{E}$$

$$\mathcal{E} = vBh = -B \frac{dA}{dt}$$



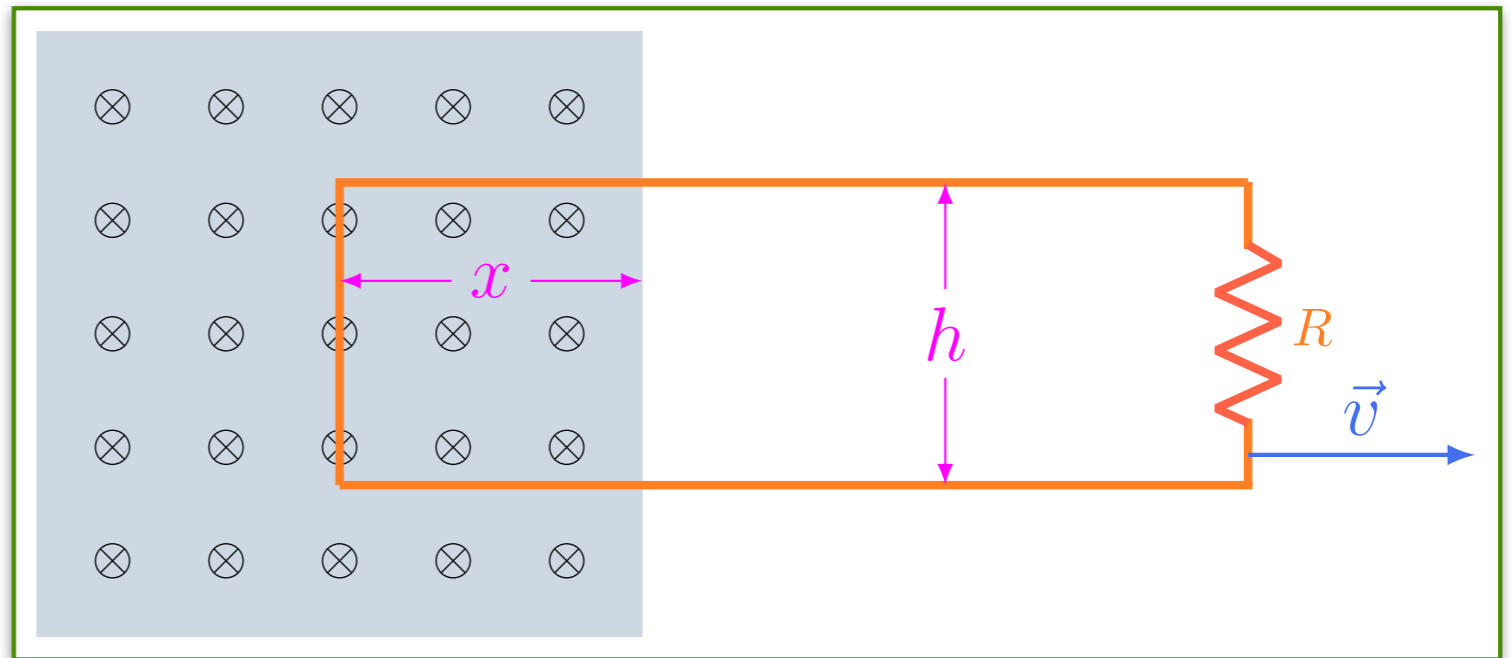
Lei de Faraday

$$\oint \vec{v} \times \vec{B} \cdot d\vec{\ell} \equiv \mathcal{E}$$

$$\mathcal{E} = vBh = -B \frac{dA}{dt}$$

$$\mathcal{E} = - \frac{d\phi}{dt}$$

Lei de Lenz

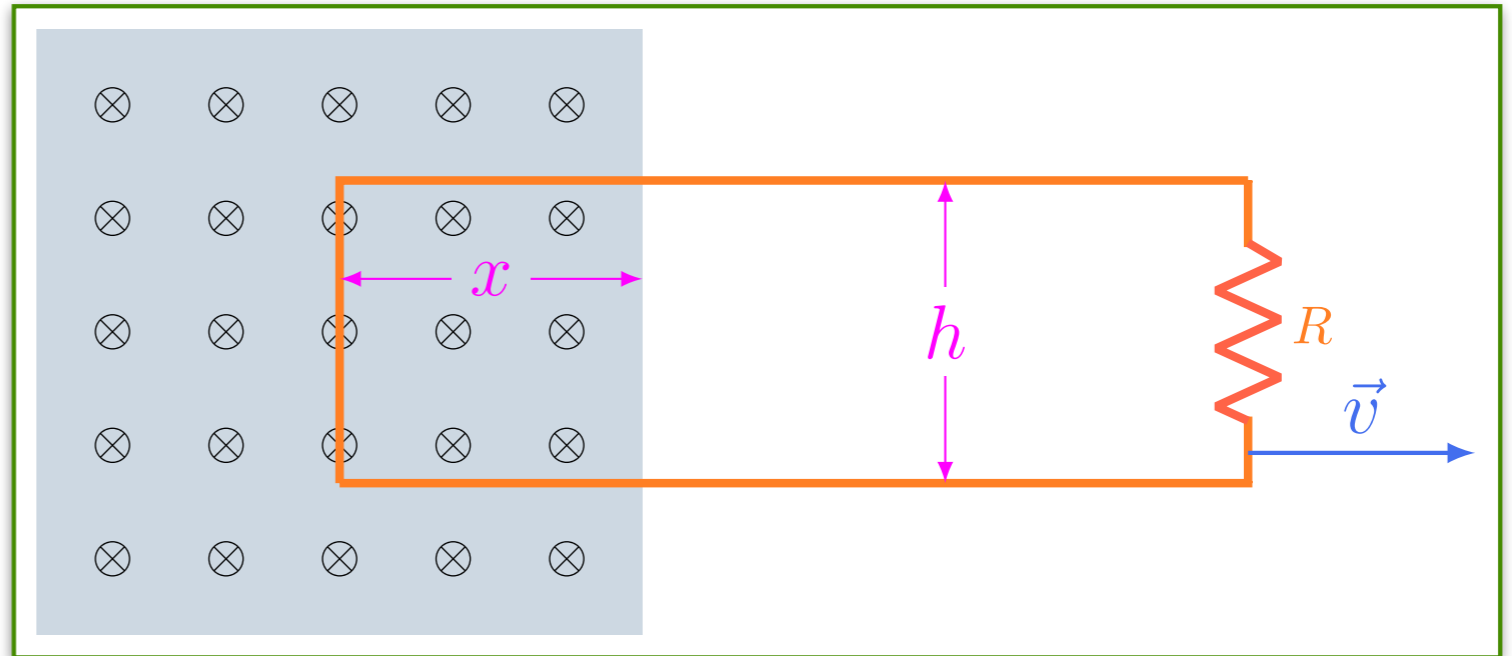


Lei de Faraday

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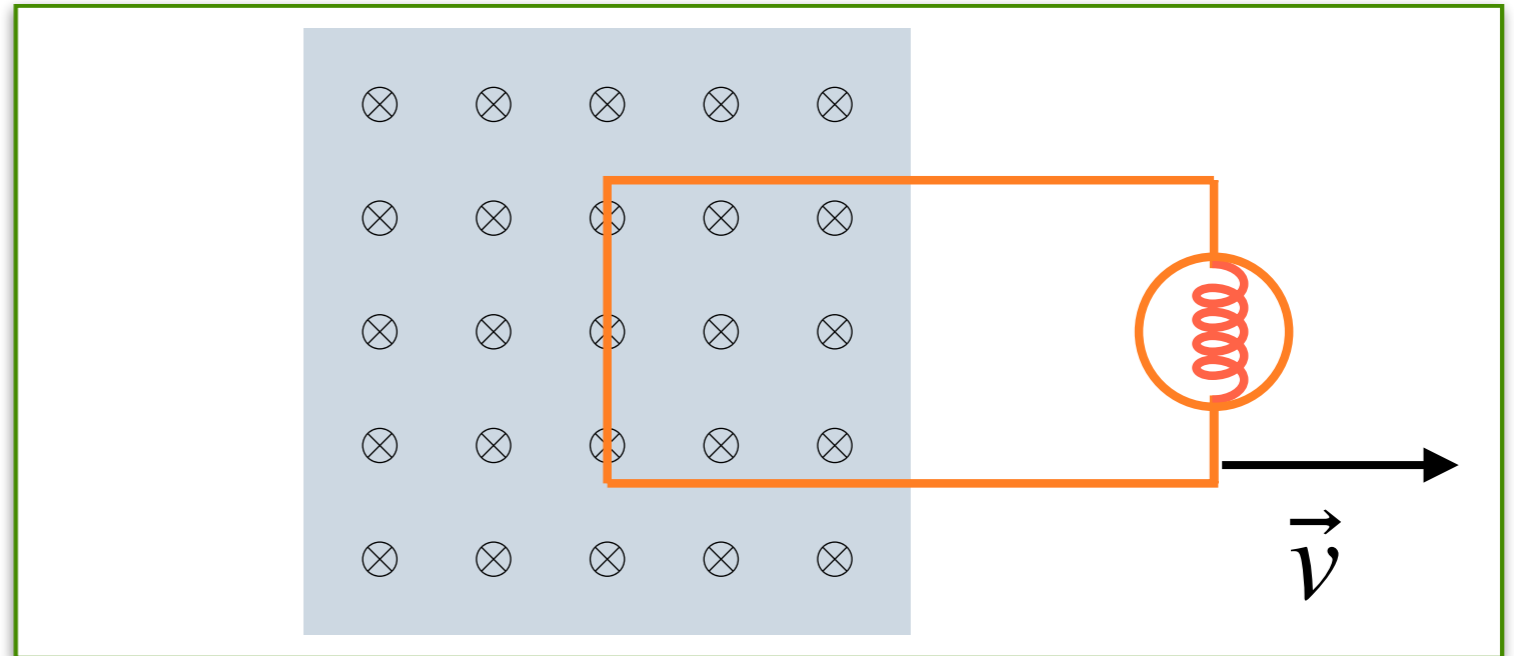
$$\mathcal{E} = vBh = -B \frac{dA}{dt}$$

$$\mathcal{E} = -\frac{d\phi}{dt}$$



Lei de Faraday

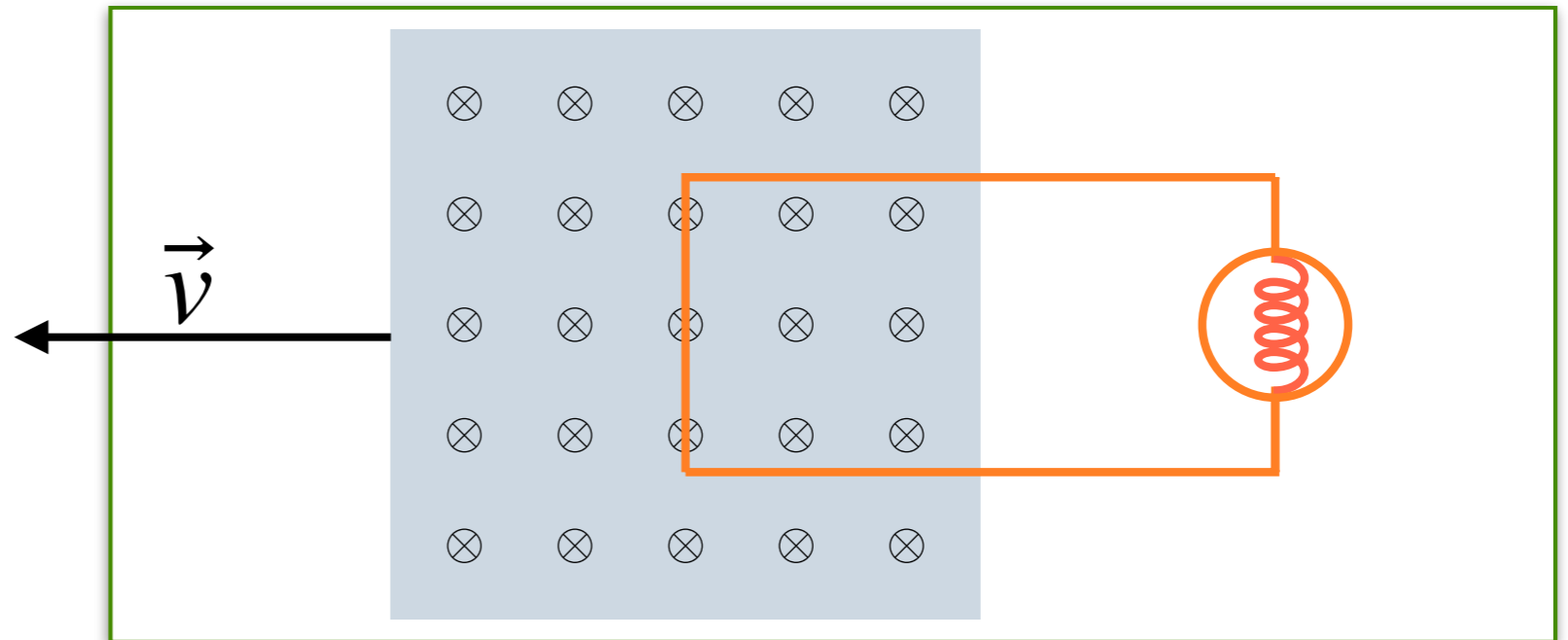
$$\mathcal{E} = -\frac{d\phi}{dt}$$



Circuito se move

Lei de Faraday

$$\mathcal{E} = -\frac{d\phi}{dt}$$

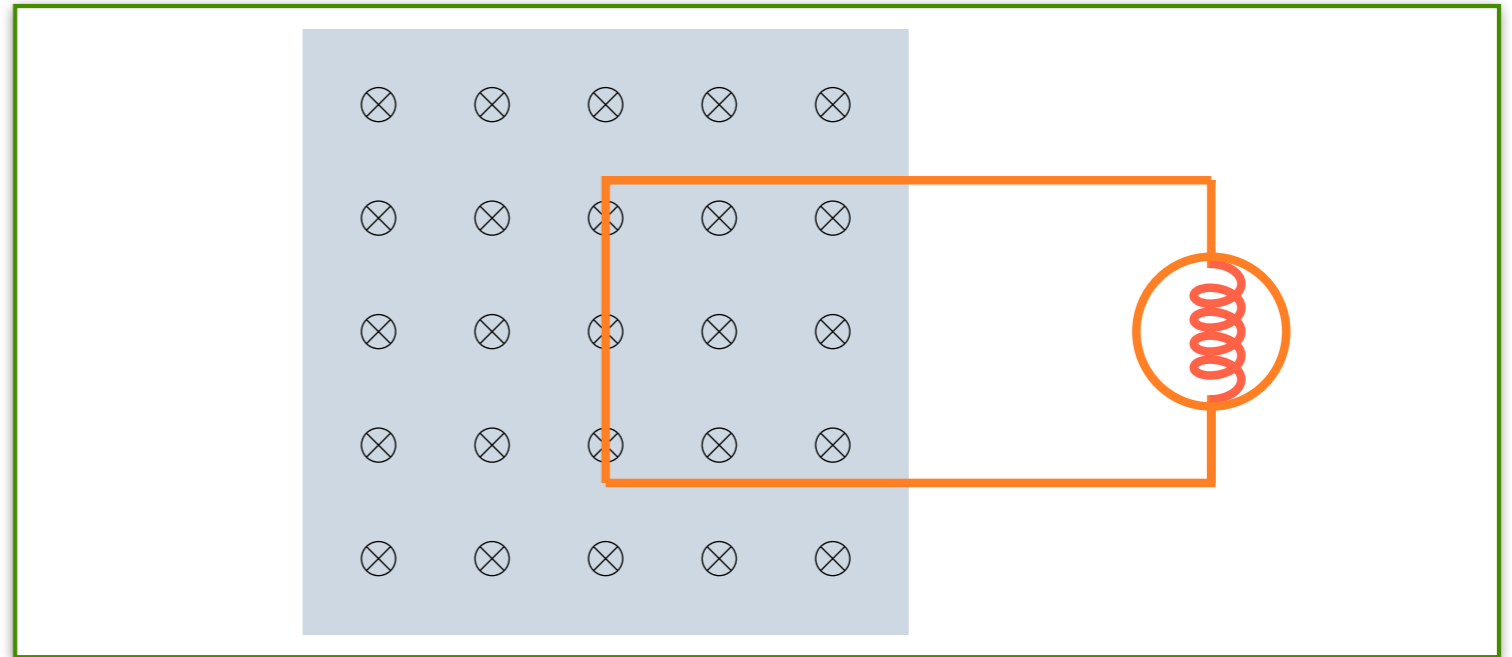


Ímã se move

Lei de Faraday

$$\mathcal{E} = -\frac{d\phi}{dt}$$

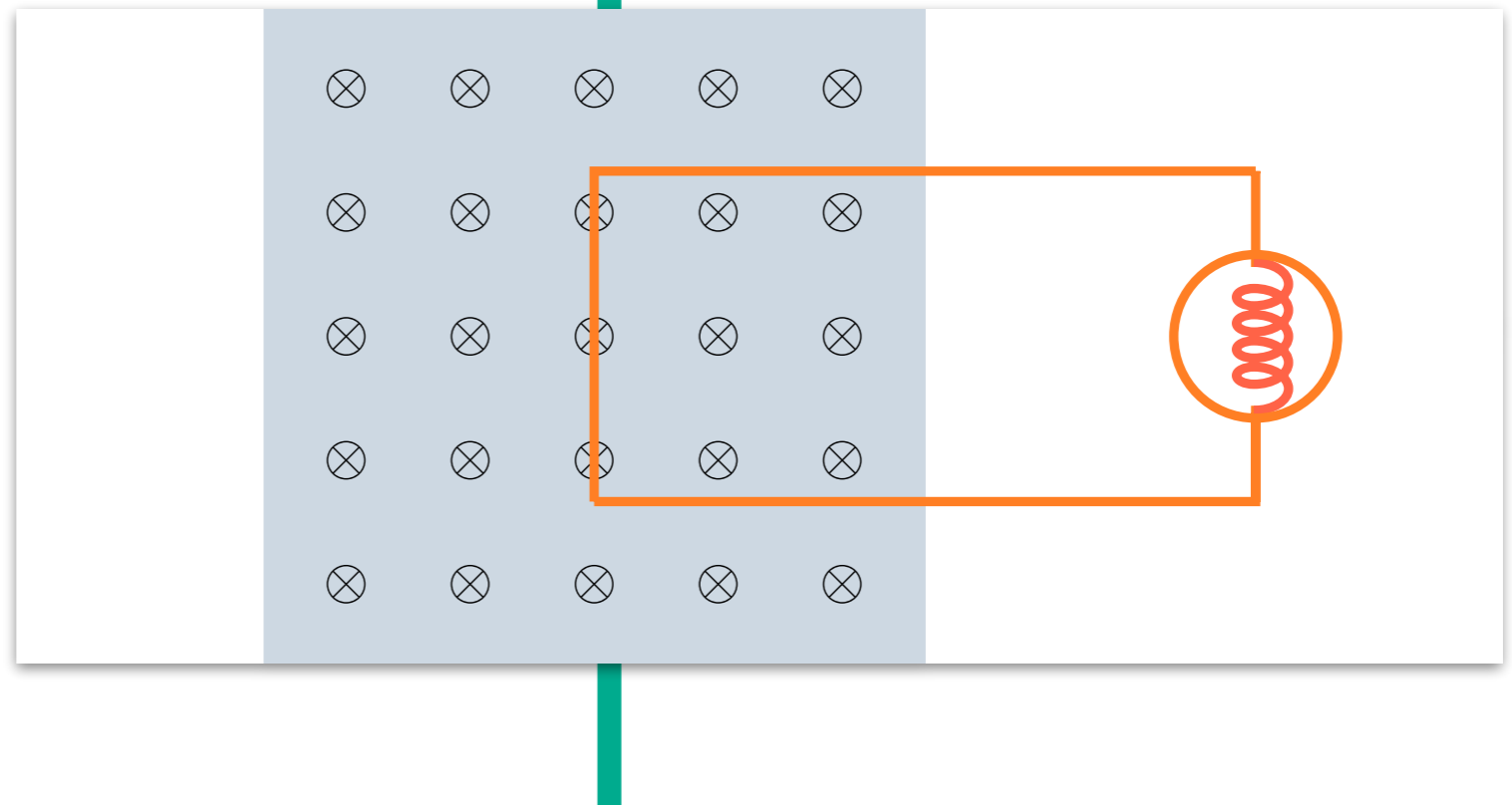
\vec{B} varia



Lei de Faraday

$$\mathcal{E} = -\frac{d\phi}{dt}$$

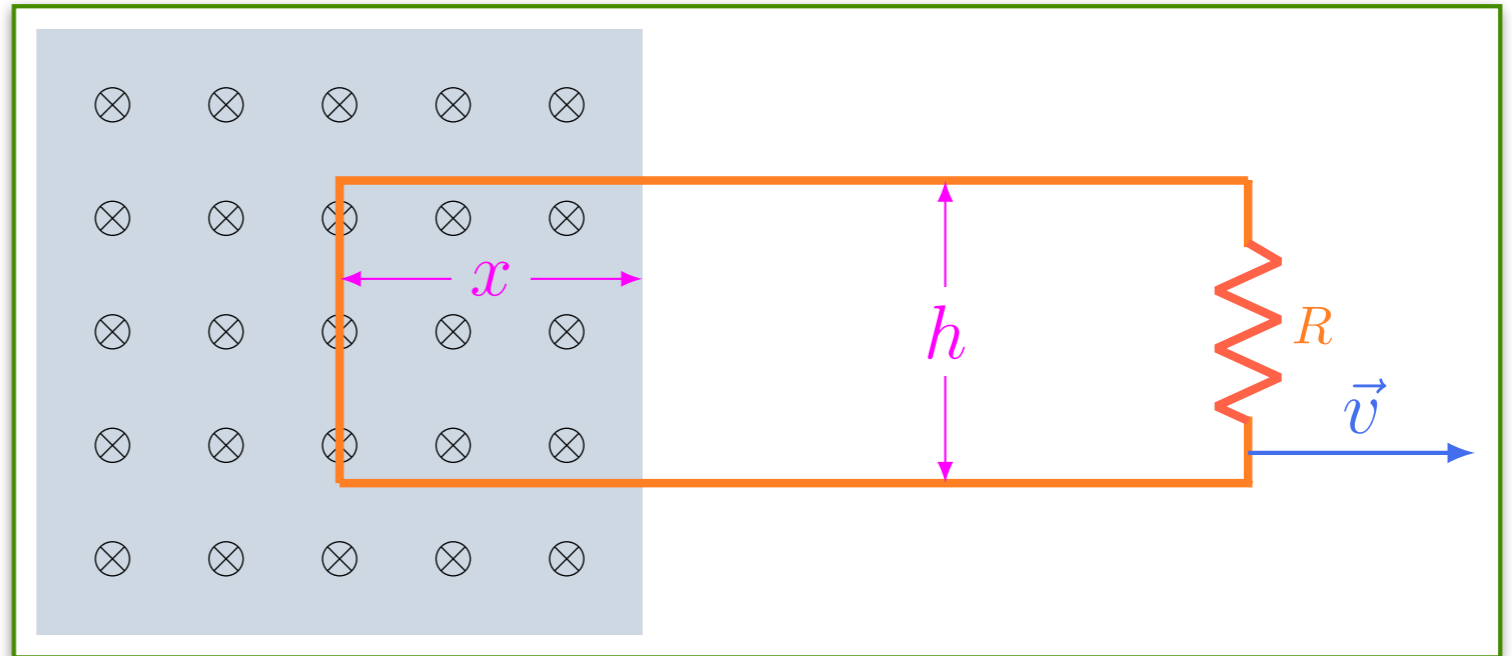
\vec{B} roda



Lei de Faraday

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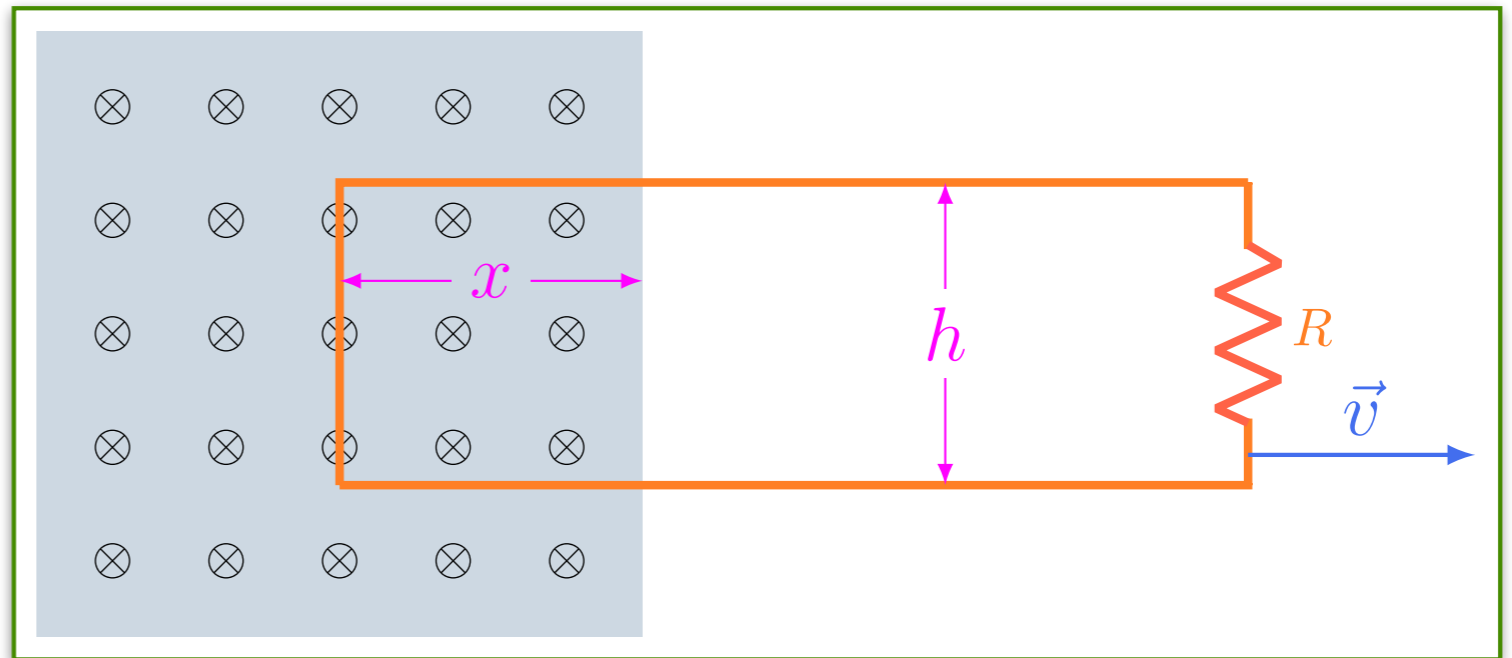
Lei de Faraday

$$\oint \vec{v} \times \vec{B} \cdot d\vec{\ell} \equiv \mathcal{E}$$

$$\mathcal{E} = vBh$$

$$\mathcal{E} = -\frac{d\phi}{dt}$$

$$\mathcal{E} = -\frac{d}{dt} \int_A \vec{B} \cdot \hat{n} da$$



Lei de Faraday

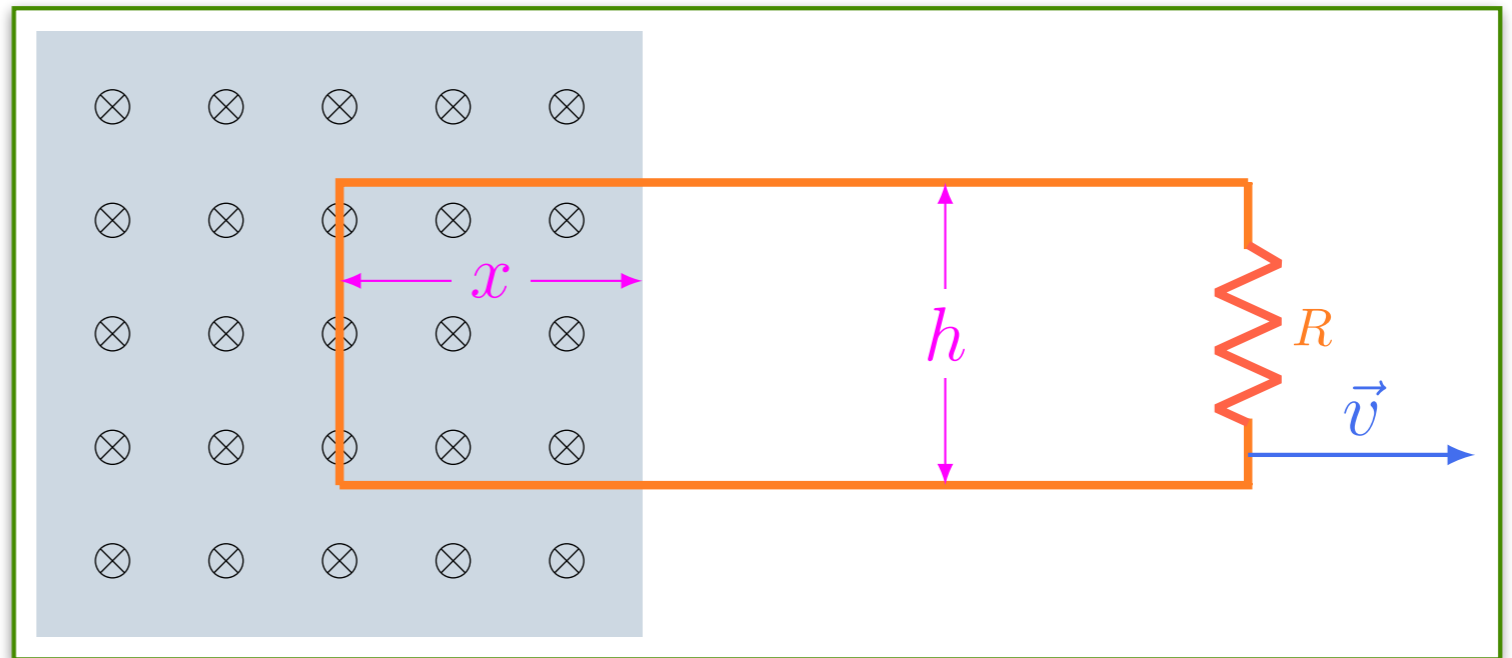
$$\oint \vec{v} \times \vec{B} \cdot d\vec{\ell} \equiv \mathcal{E}$$

$$\mathcal{E} = vBh$$

$$\mathcal{E} = -\frac{d\phi}{dt}$$

$$\mathcal{E} = -\int_{\mathcal{A}} \frac{\partial \vec{B}}{\partial t} \cdot \hat{n} da$$

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



Lei de Faraday

$$\oint \vec{v} \times \vec{B} \cdot d\vec{\ell} \equiv \mathcal{E}$$

$$\mathcal{E} = vBh$$

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