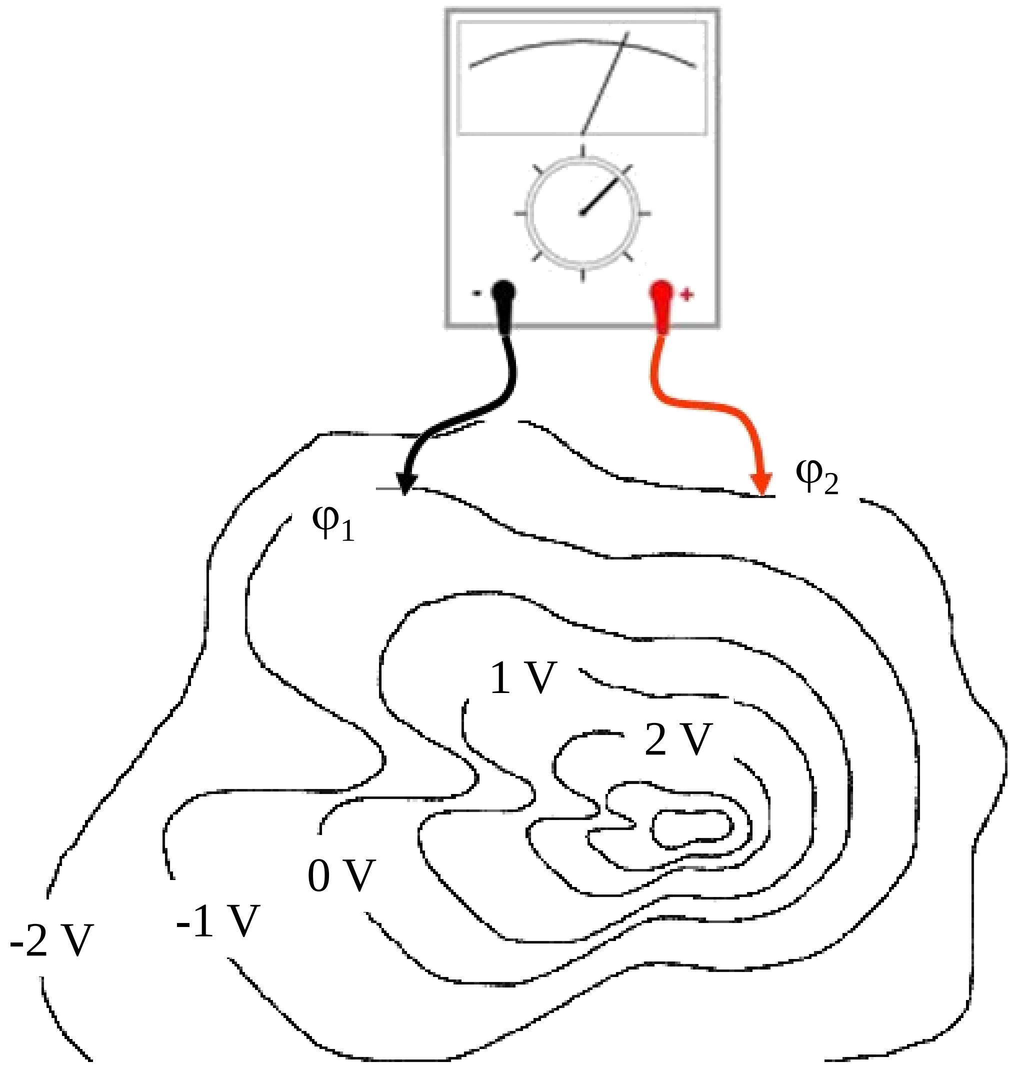
Spannung

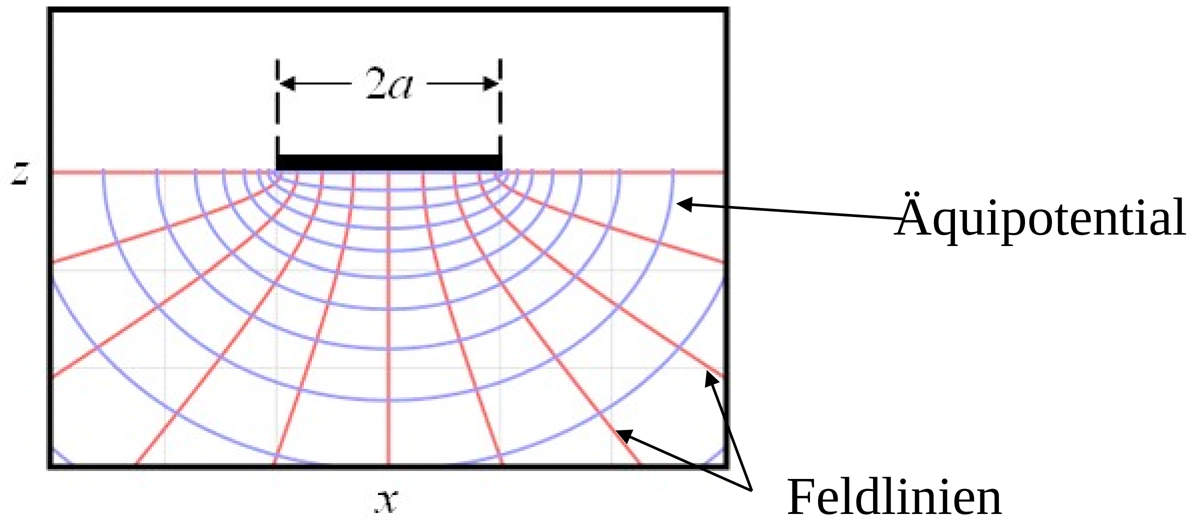
$$V = \varphi_2 - \varphi_1$$ Volts

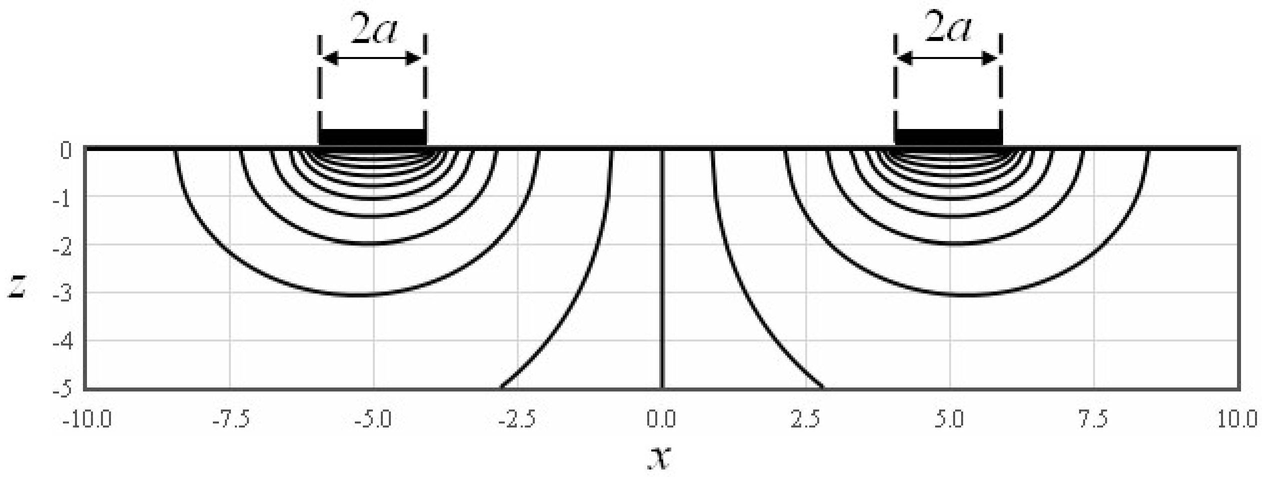
Elektrostatische Potential [Volts]

$$\vec{E} = -\nabla \varphi$$



Äquipotentialfläche - Feldlinien





Elektrostatik

$$q_i$$

$$\vec{E}(\vec{r}) = \sum_{i=1}^{N} \frac{q_i(\vec{r}-\vec{r}_i)}{4\pi\varepsilon_0 \left|\vec{r}-\vec{r}_i\right|^3}$$

$$\varphi(\vec{r}) = \sum_i \frac{q_i}{4\pi\varepsilon_0 \left|\vec{r}-\vec{r}_i\right|}$$

$$\vec{E}$$

$$\varphi = -\int \vec{E} \cdot d\vec{r} + \varphi_0$$

$$\vec{E} = -\nabla \varphi$$

$$\varphi$$

Ladungsdichte

für viele elektrische Ladungen

$$\sum_i q_i \quad \Rightarrow \quad \rho(\vec{r})$$

$$\vec{E}(\vec{r}) = \sum_{i=1}^{N} \frac{q_i(\vec{r} - \vec{r}_i)}{4\pi\varepsilon_0 \left|\vec{r} - \vec{r}_i\right|^3}$$

$$\vec{E}(\vec{r}) = \frac{1}{4\pi\varepsilon_0} \iiint_{vol} \frac{\rho(\vec{r}\,')}{\left|\vec{r} - \vec{r}\,'\right|^3} (\vec{r} - \vec{r}\,') dx' dy' dz'$$

Elektrostatik

$$\rho$$

$$\vec{E}(\vec{r}) = \frac{1}{4\pi\varepsilon_0}\int \frac{\rho(\vec{r}\,')}{\left|\vec{r}-\vec{r}\,'\right|^3}(\vec{r}-\vec{r}\,')d^3r'$$

$$\nabla \cdot \vec{E} = \frac{\rho}{\varepsilon_0}$$

$$\vec{E}$$

$$\varphi = -\int \vec{E}\cdot d\vec{r} + \varphi_0$$

$$\vec{E} = -\nabla\varphi$$

$$\varphi$$

Gaußsches Gesetz

$$\nabla \cdot \vec{E} = \frac{\rho}{\varepsilon_0}$$

Divergenz

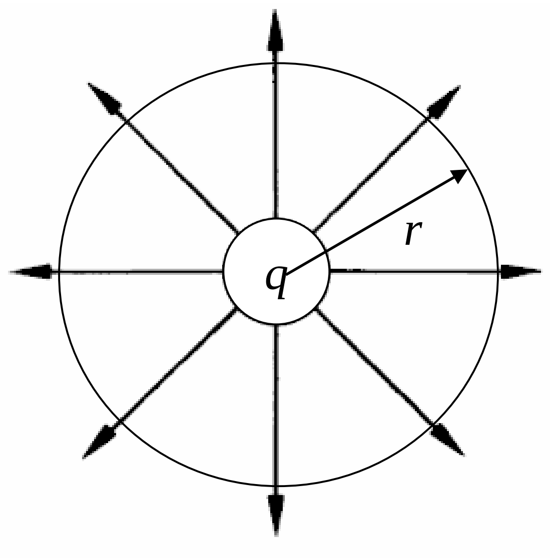
elektrische Feldkonstante

$8.854187817 \times 10^{-12} \quad \frac{\text{A s}^4}{\text{kg m}^3}$

$$\nabla \cdot \vec{E} = \text{div}\, \vec{E} = \frac{\partial E_x}{\partial x} + \frac{\partial E_y}{\partial y} + \frac{\partial E_z}{\partial z}$$

Gaußsches Gesetz

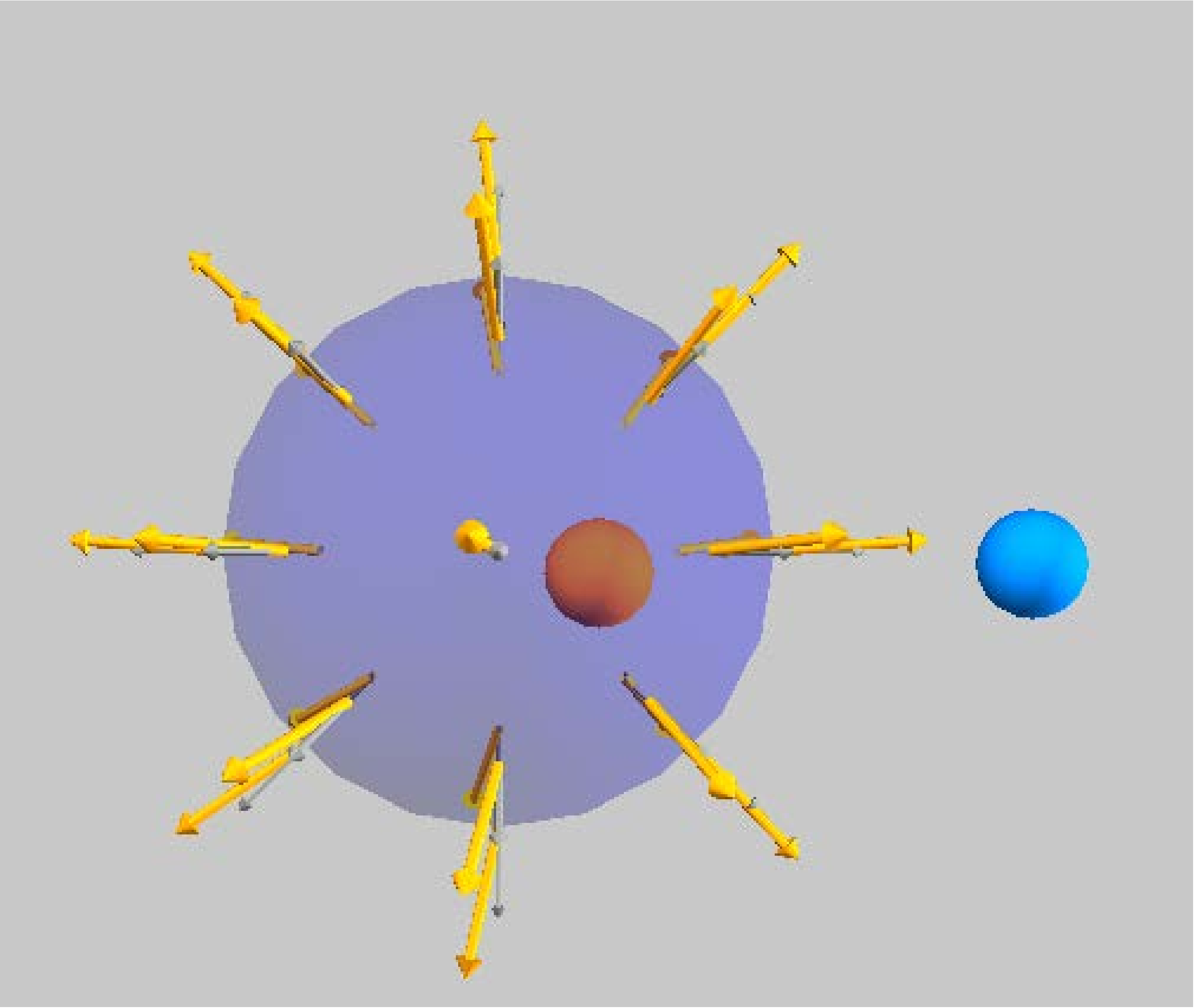
$$\vec{E}(\vec{r}) = \frac{q}{4\pi\varepsilon_0 r^2}\hat{r}$$



Elektrisches Feld × Oberfläche = $\frac{q}{4\pi\varepsilon_0 r^2} \times 4\pi r^2 = \frac{q}{\varepsilon_0}$

$$\nabla \cdot \vec{E} = \frac{\rho}{\varepsilon_0}$$

Gaußsches Gesetz

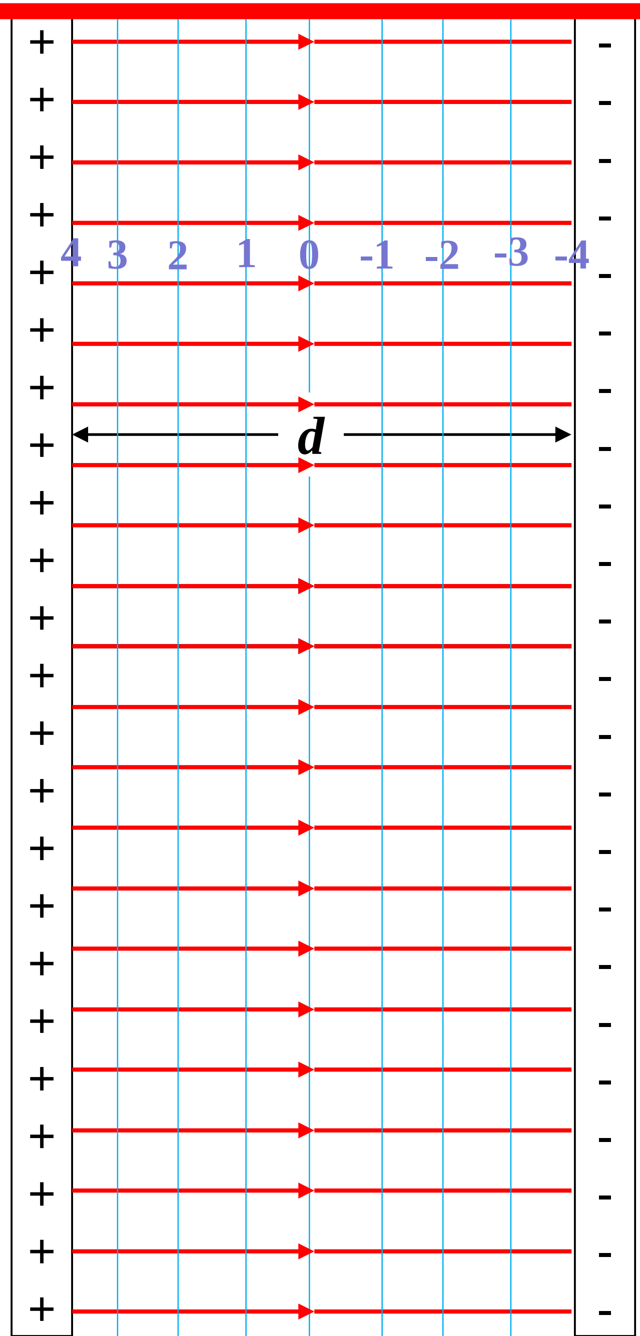


http://public.mitx.mit.edu/gwt-teal/GaussLawFlux.html

parallen Platten

$$\varphi_{links} = 4\ [\mathrm{V}]$$

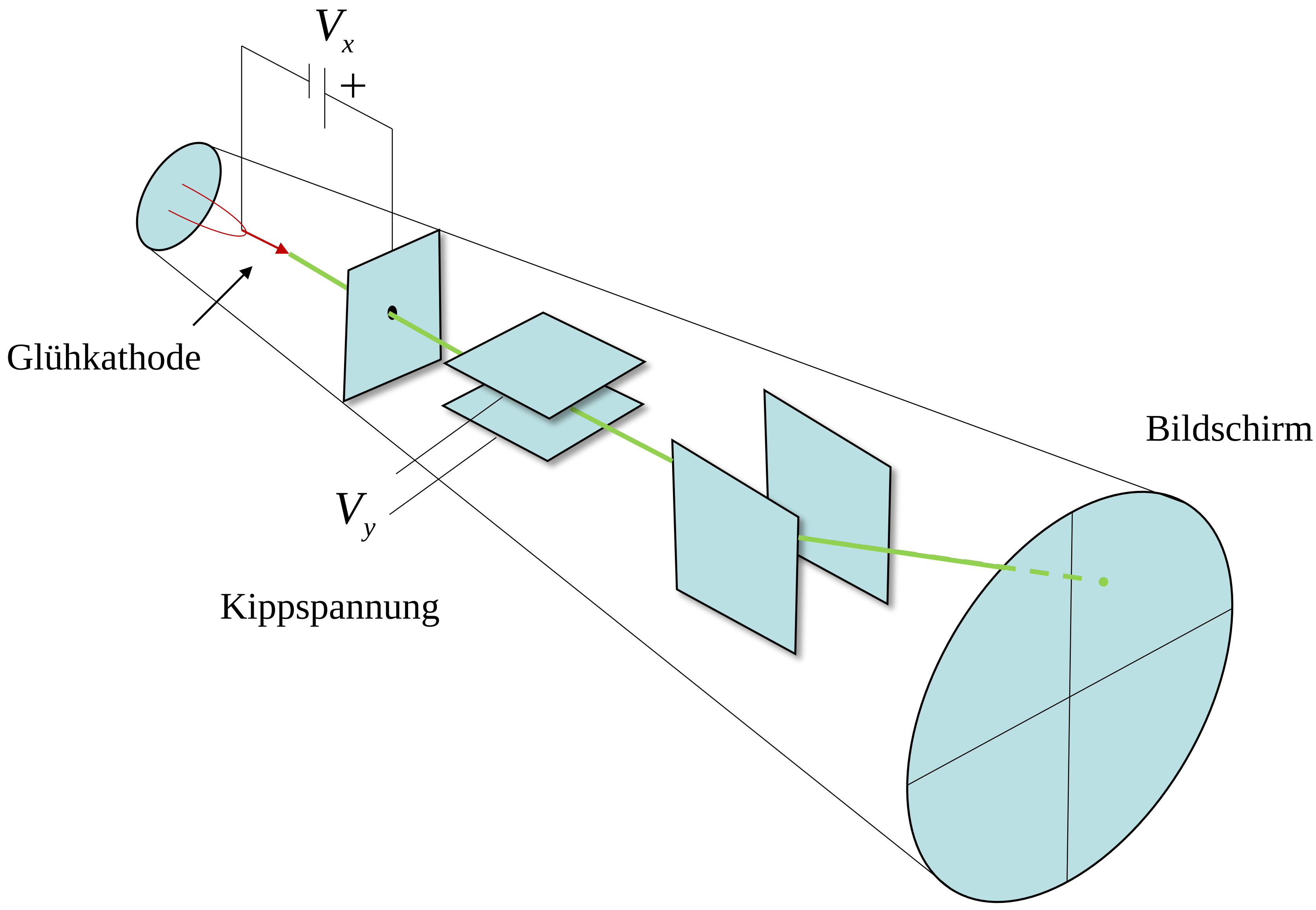
$$\varphi_{rechts} = -4\ [\mathrm{V}]$$

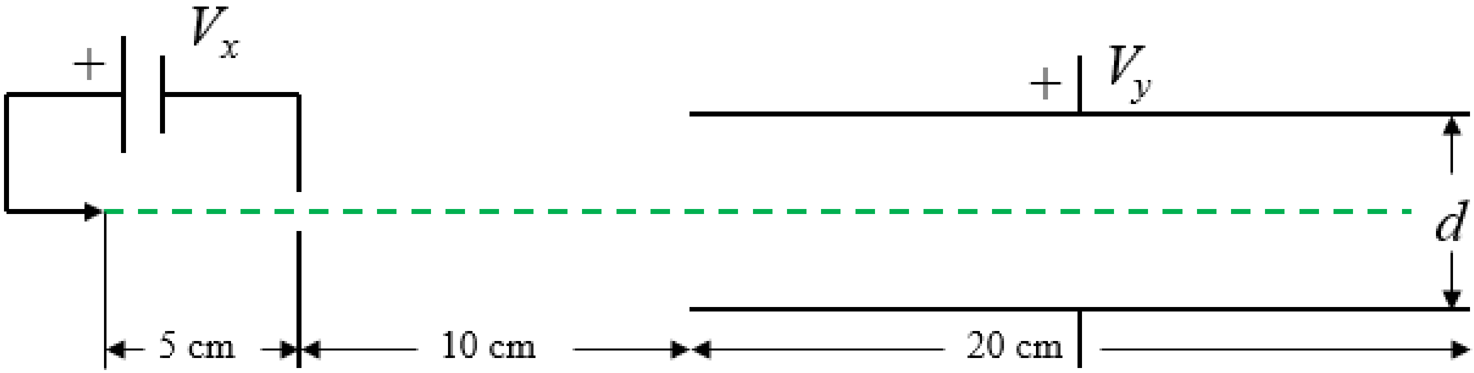


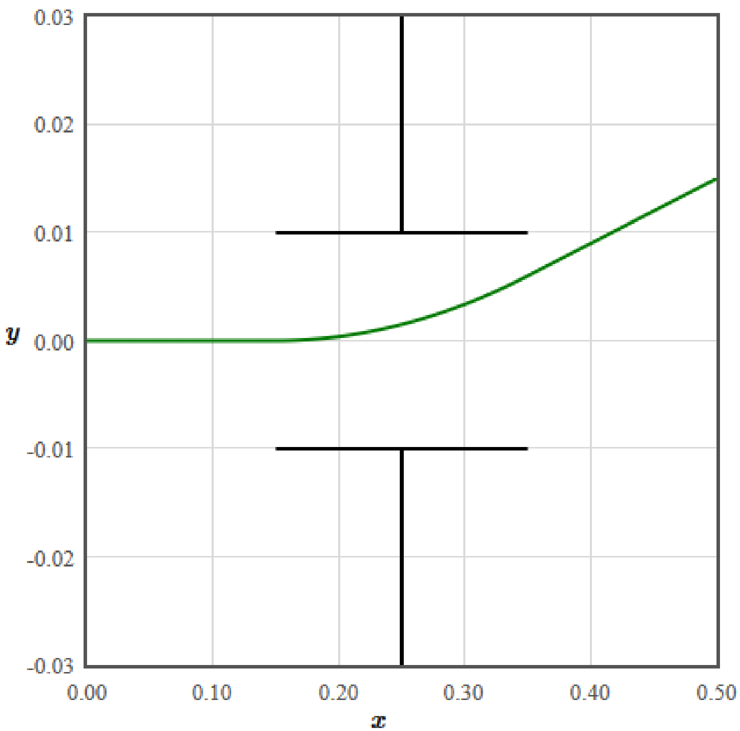
$$V = \varphi_{links} - \varphi_{rechts}$$
$$= 8\ [\mathrm{V}]$$

$$\vec{E} = -\nabla\varphi$$
$$= -\frac{\partial\varphi}{\partial x}\hat{x}$$
$$= \frac{V}{d}\ \hat{\mathrm{x}}\ [\mathrm{V/m}]$$

Elektronenstrahl







$V_x = 5000$ [V]

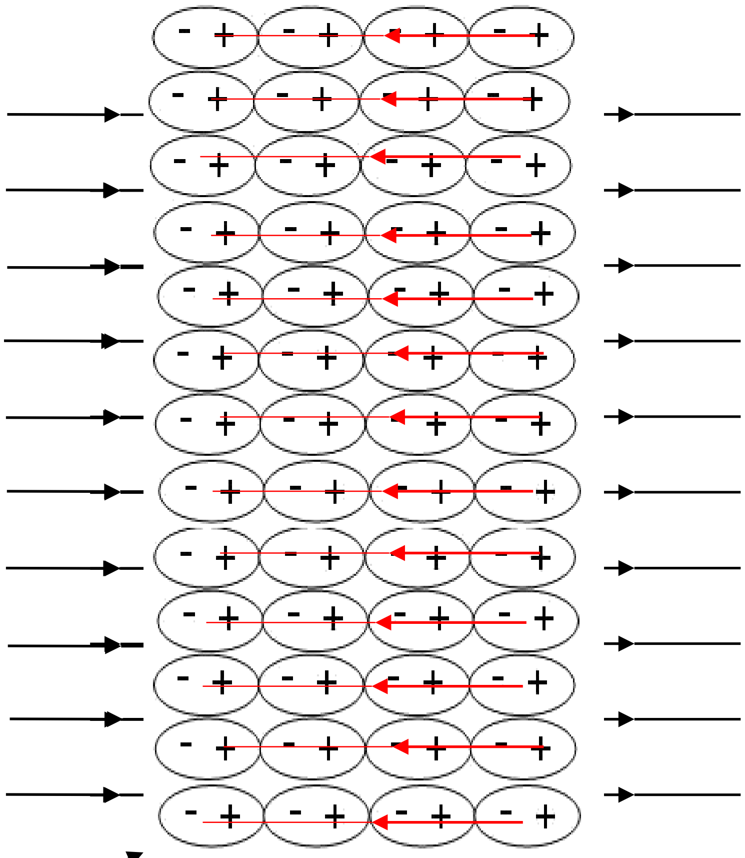
$V_y = 60$ [V]

$d = 0.02$ [m]

Dielektrikum

$$\varepsilon_r = \frac{E_{vacuum}}{E_{dielektr}}$$

relative Dielektrizitätszahl



Nichtleiter (Isolator)

Elektrostatik

$$\rho$$

$$\vec{E}(\vec{r}) = \frac{1}{4\pi\varepsilon_r\varepsilon_0}\int\frac{\rho(\vec{r}\,')}{\left|\vec{r}-\vec{r}\,'\right|^3}(\vec{r}-\vec{r}\,')d^3r'$$

$$\nabla\cdot\vec{E} = \frac{\rho}{\varepsilon_r\varepsilon_0}$$

$$\vec{E}$$

$$\varphi = -\int\vec{E}\cdot d\vec{r} + \varphi_0$$

$$\vec{E} = -\nabla\varphi$$

$$\varphi$$

Millikan-Versuch