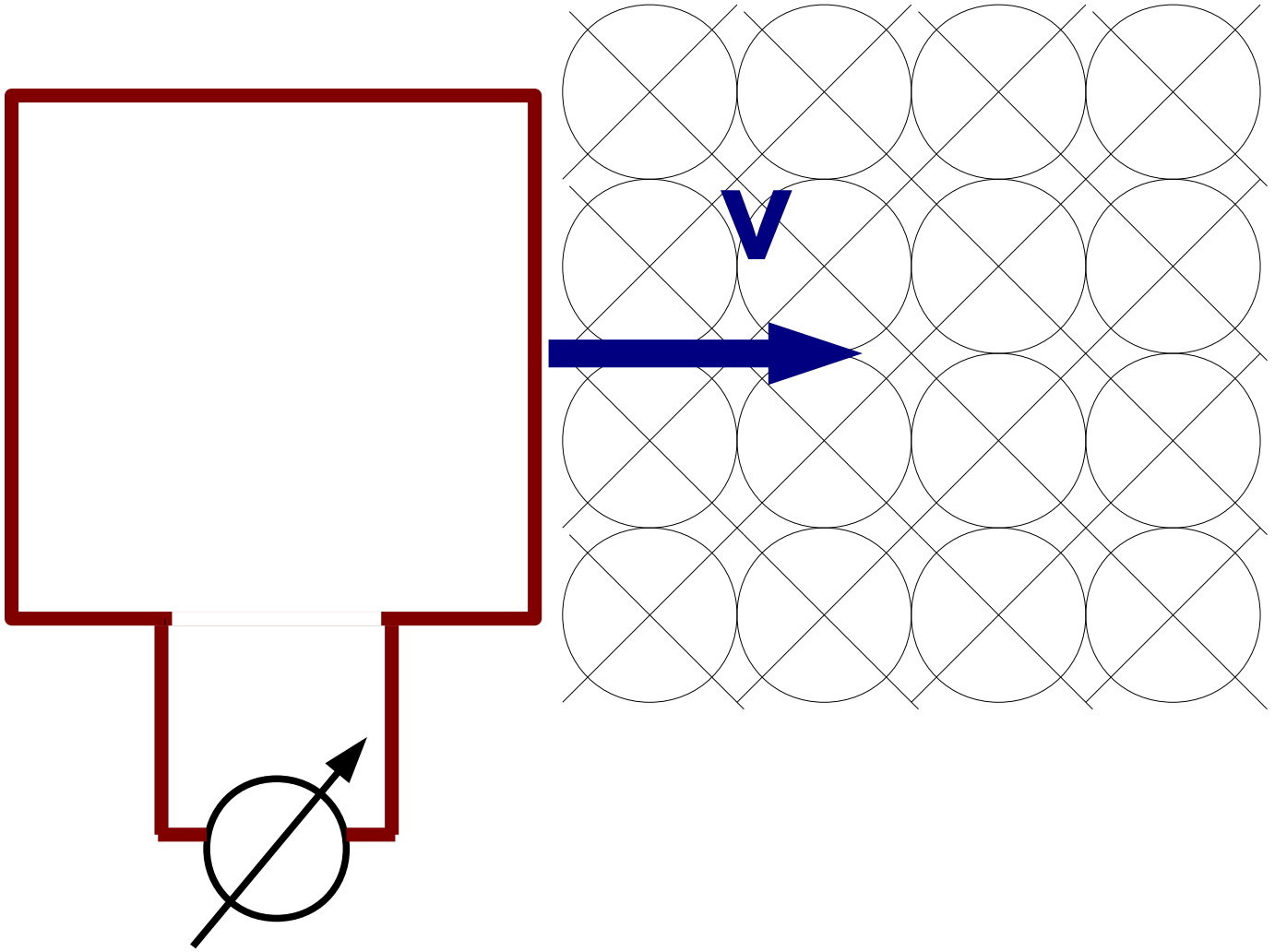
Magnetometrie

Dirk Walecki 25.10.2011

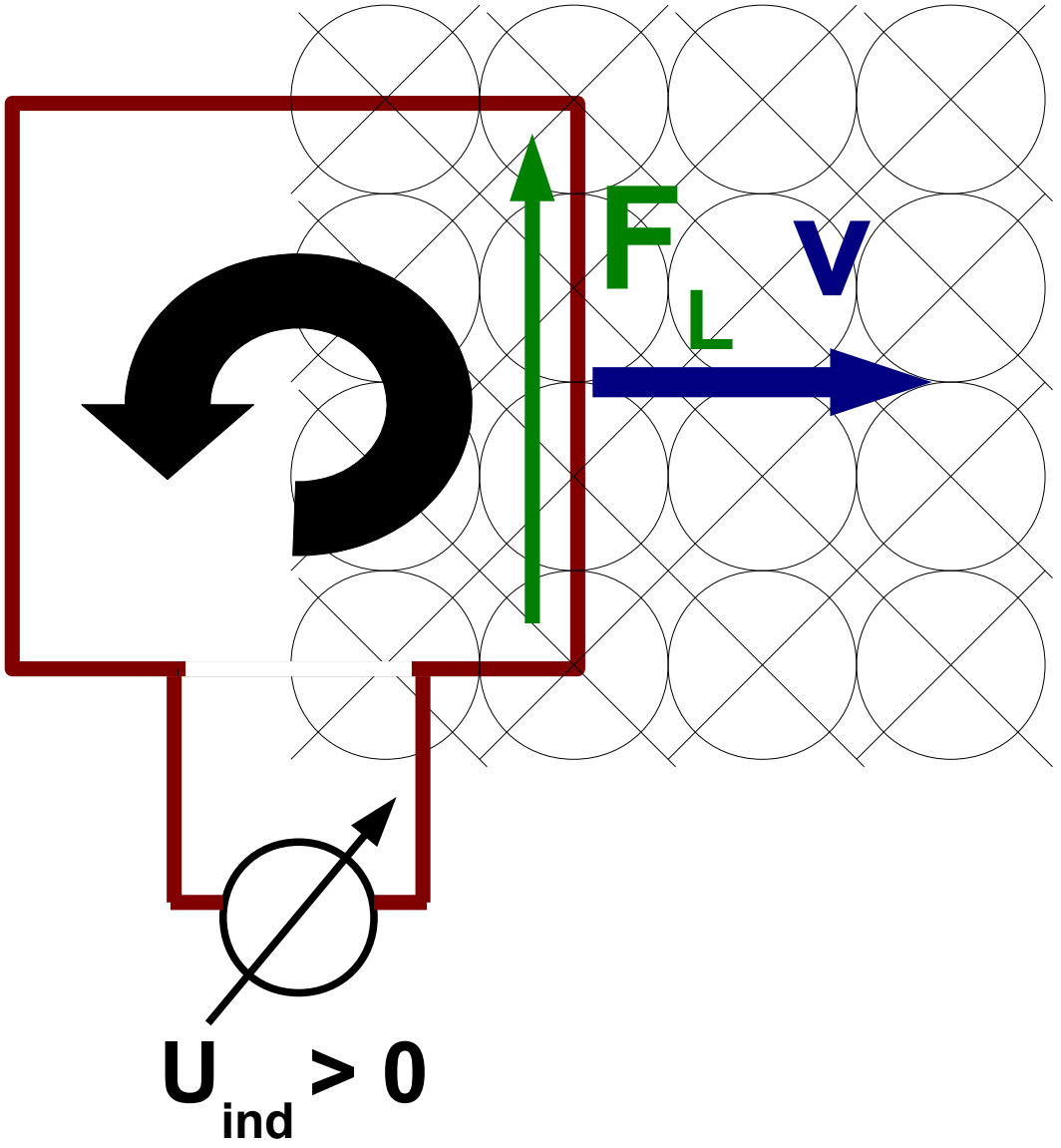
Inhalt

Faraday'sches Induktionsgesetz

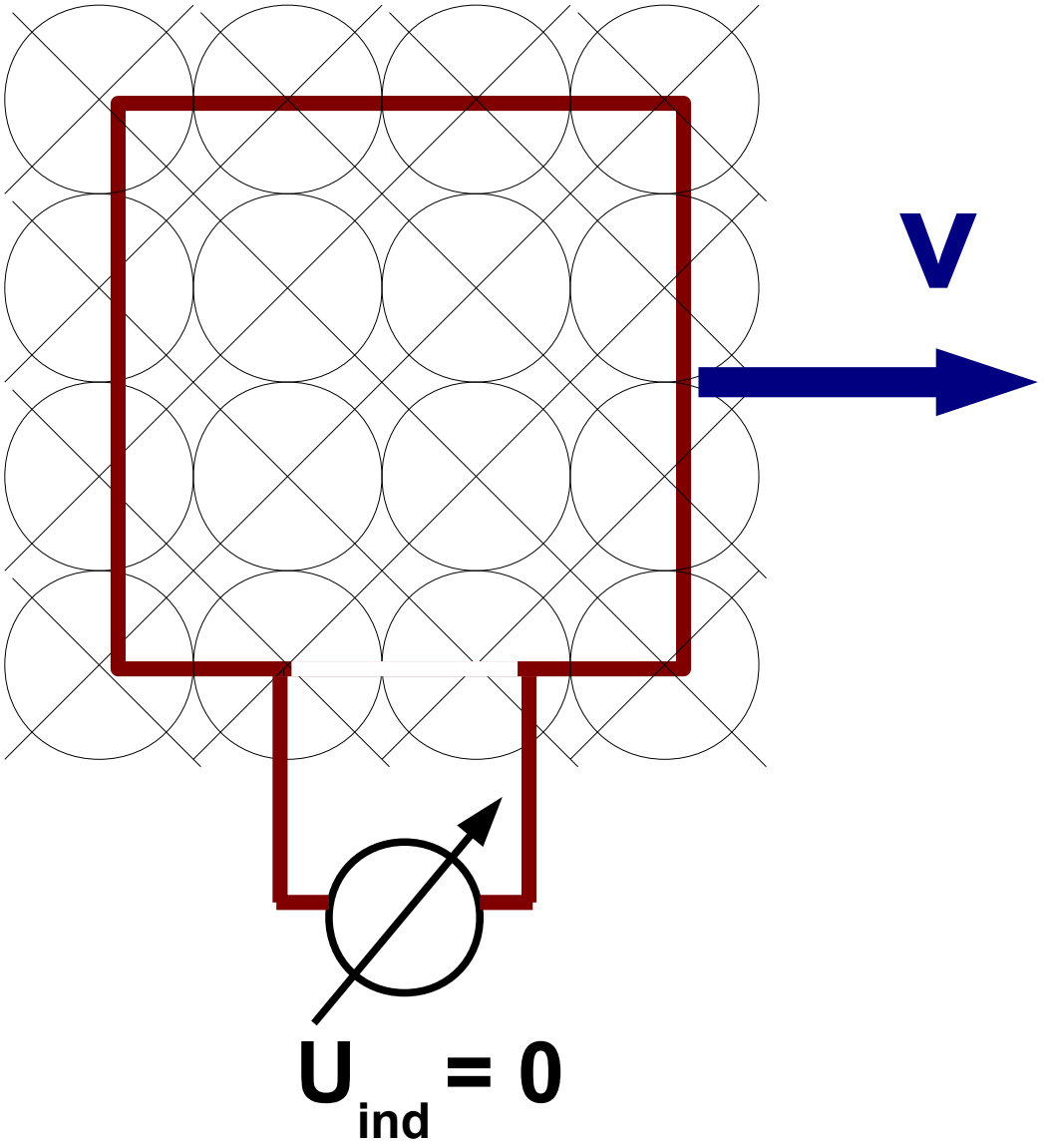


$U_{ind} = 0$

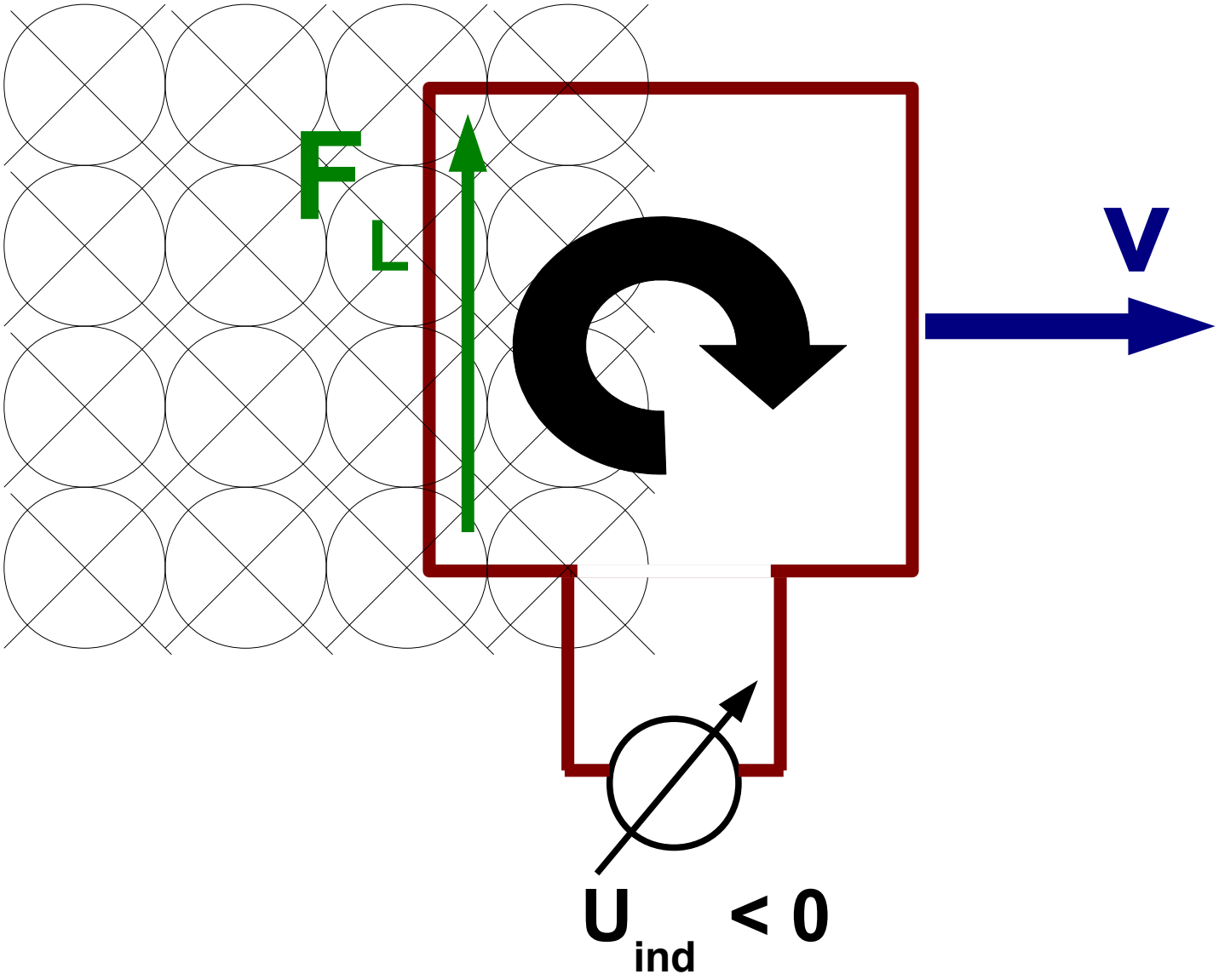
Faraday'sches Induktionsgesetz



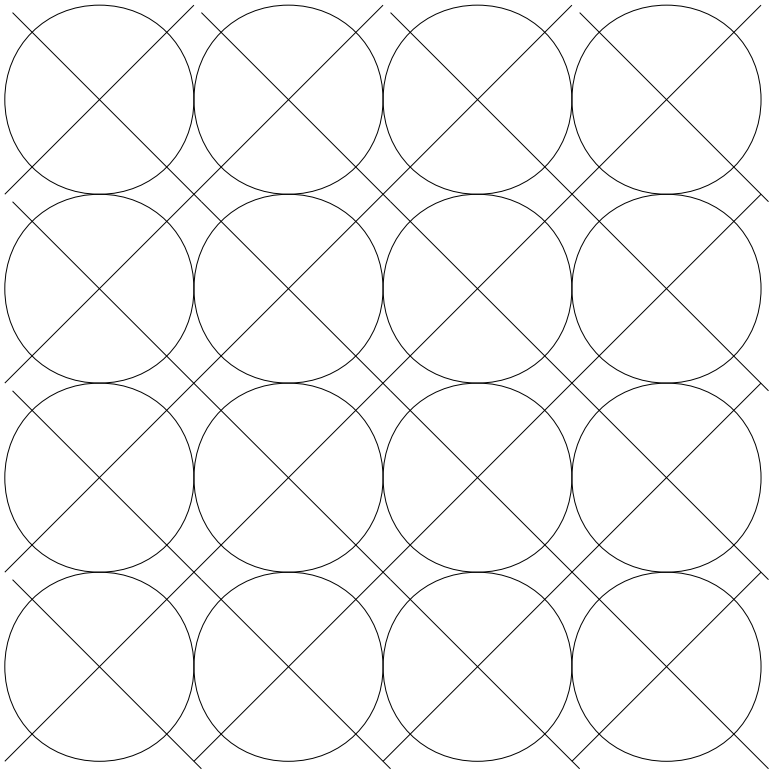
Faraday'sches Induktionsgesetz

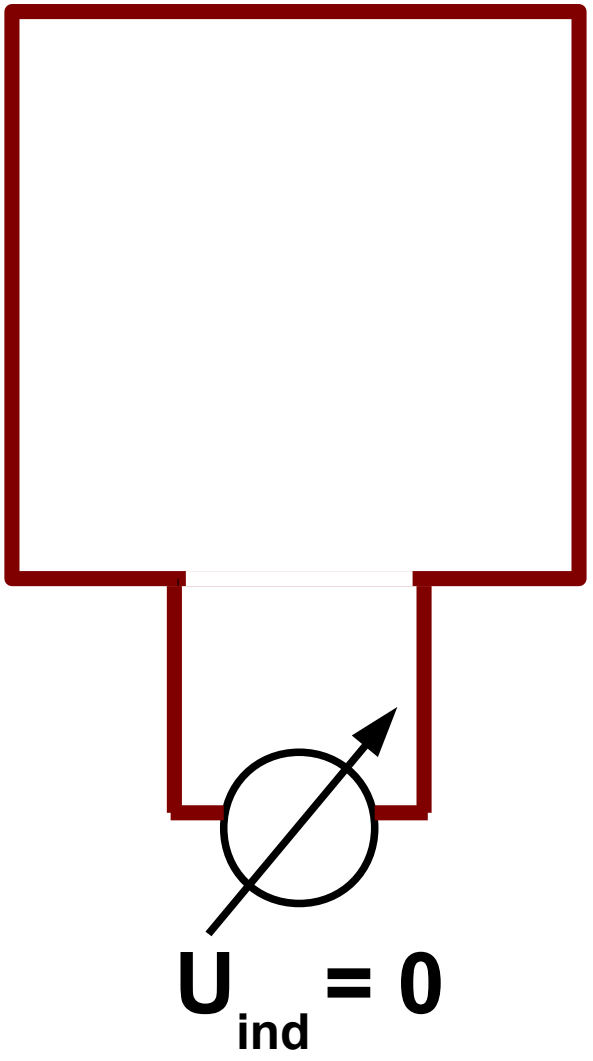


Faraday'sches Induktionsgesetz



Faraday'sches Induktionsgesetz





nach: wwwex.physik.uni-ulm.de

Faraday'sches Induktionsgesetz

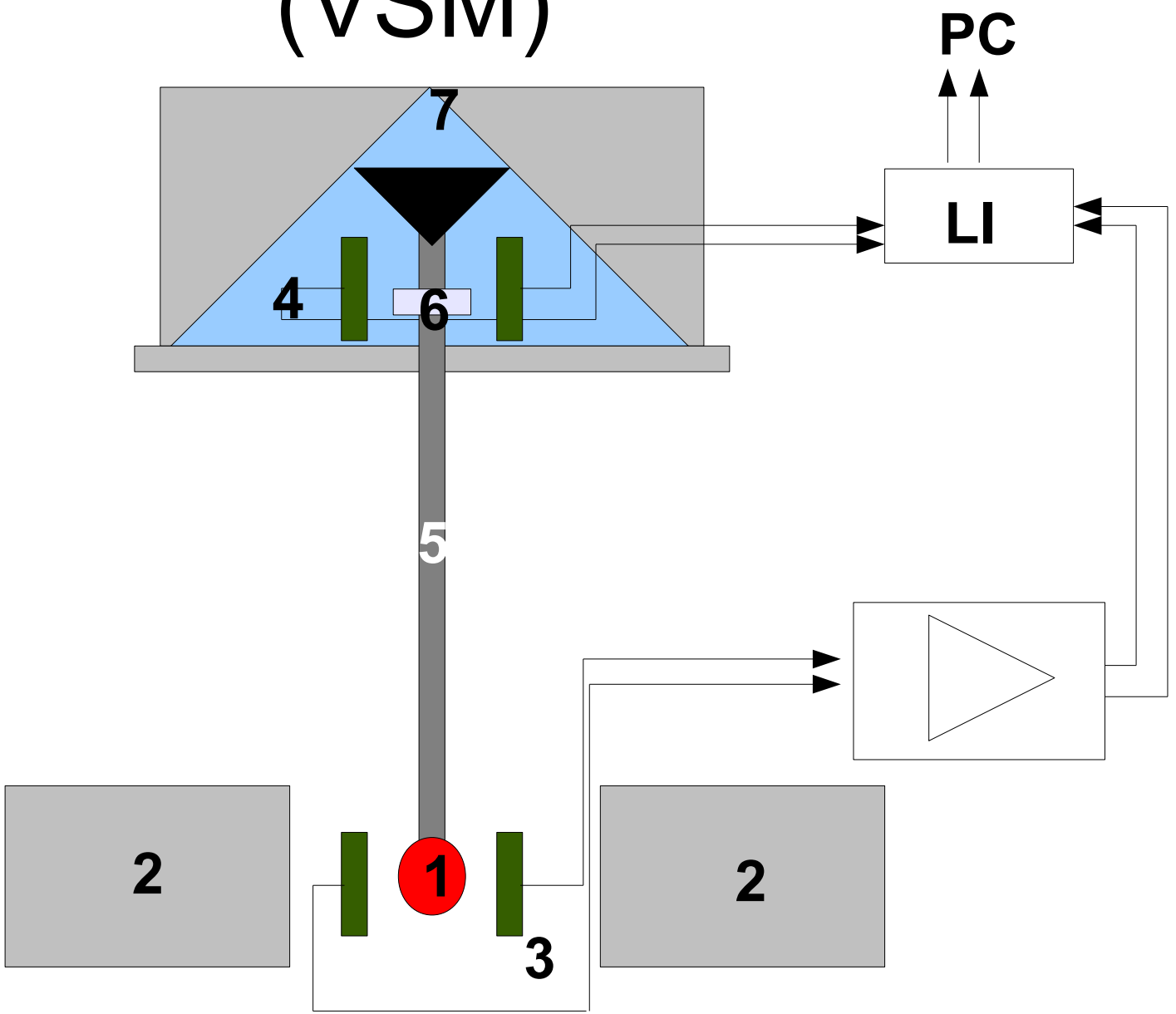
$$U_{ind} = -\frac{d\,\Phi}{dt}$$

Lenz'sche Regel:
Der Induktionsstrom ist stets so gerichtet, dass er die Ursache seiner Entstehung zu hemmen sucht. Quelle: http://www.leifiphysik.de/

$$\Phi(t) - \Phi(0) = -\int_0^t U\,dt$$

(Messung des B-Feldes über Leiterschleife)

Vibrating Sample Magnetometer (VSM)



$$B(y) = \frac{1}{2\pi} \cdot \frac{\mu_0 m}{y^3}$$

$$U_{ind} = 2\,N\,F\,\frac{dB_y}{dt}$$

Probe schwingt mit : $z = z_0 + \Delta \sin(\omega t)$

$$U_{ind} = \frac{3\,N\,F\,\mu_0 m\,\Delta\omega}{\pi\,z_0^{\,4}} \cos(\omega t)$$

kleinstes messbares magn. Moment: $\mu_0 m_{min} = 1{,}33 \cdot 10^{-14}\,Vsm$

VSM

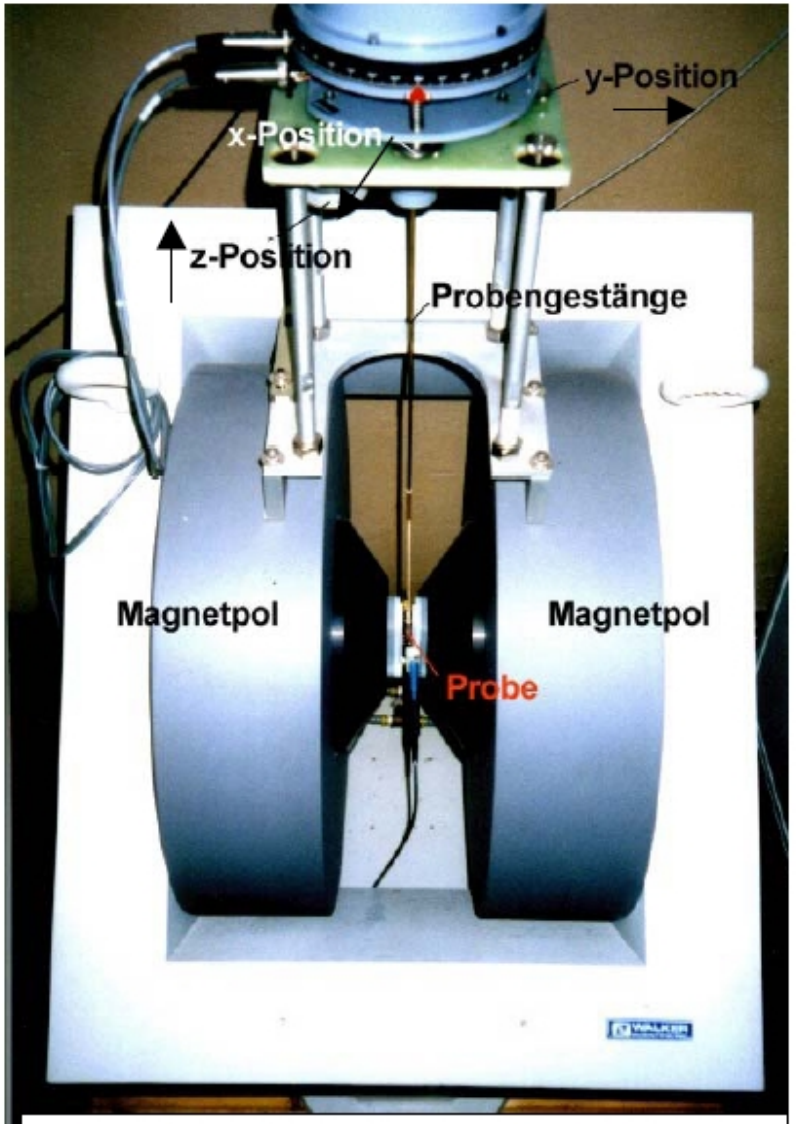
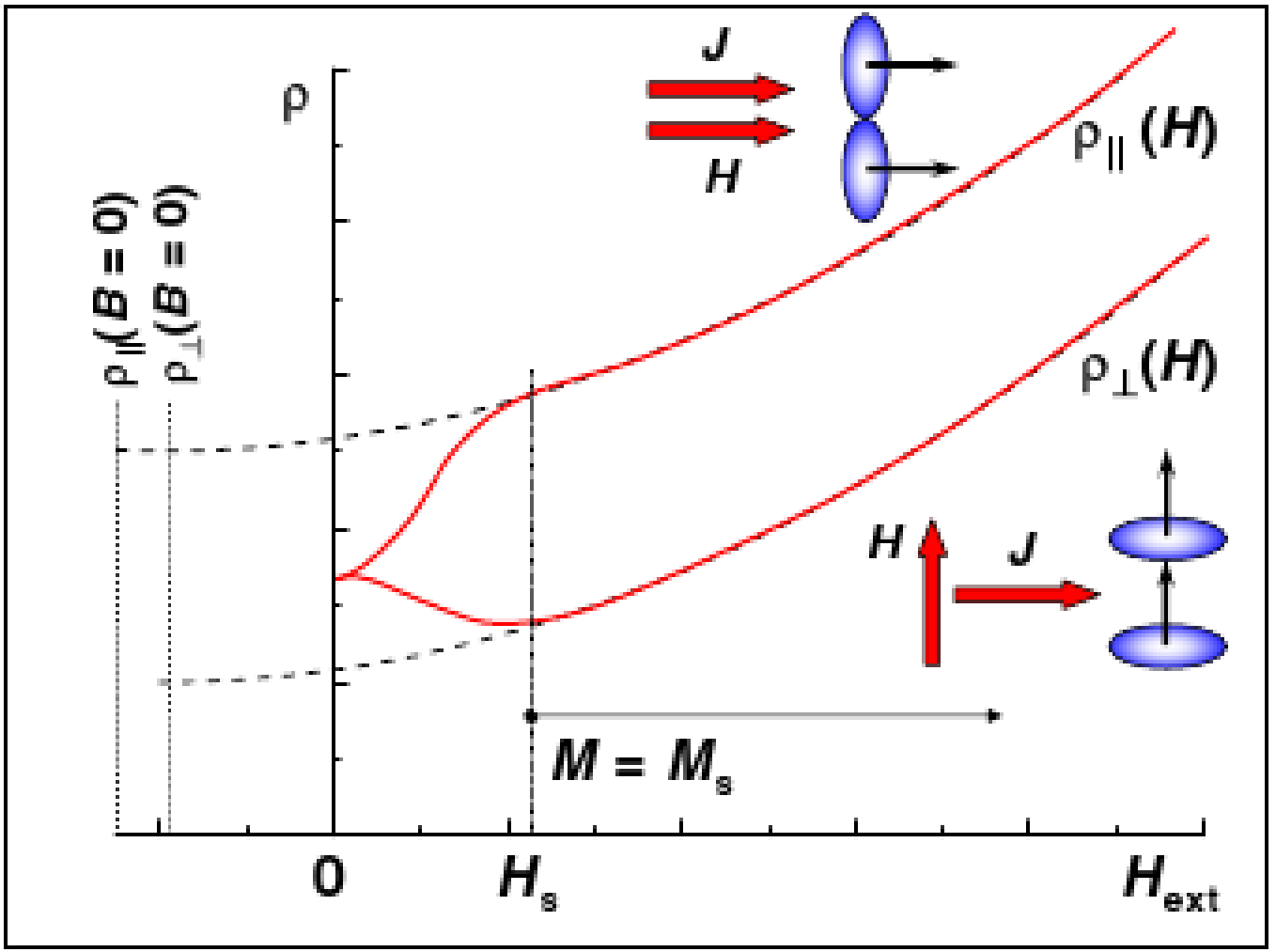


Bild 4: Magnet des VSM 7300

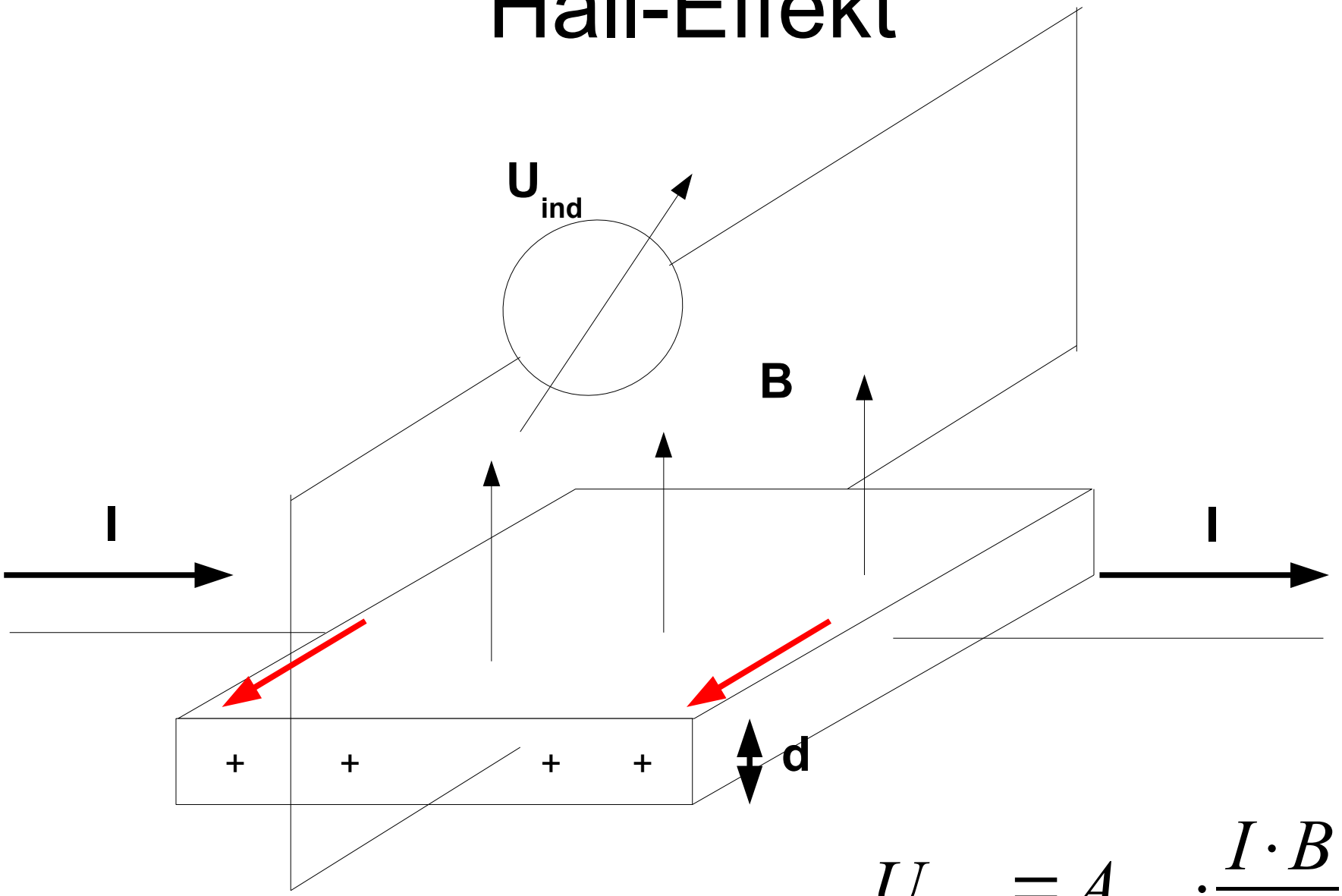
http://www.tu-ilmenau.de

AMR-Effekt



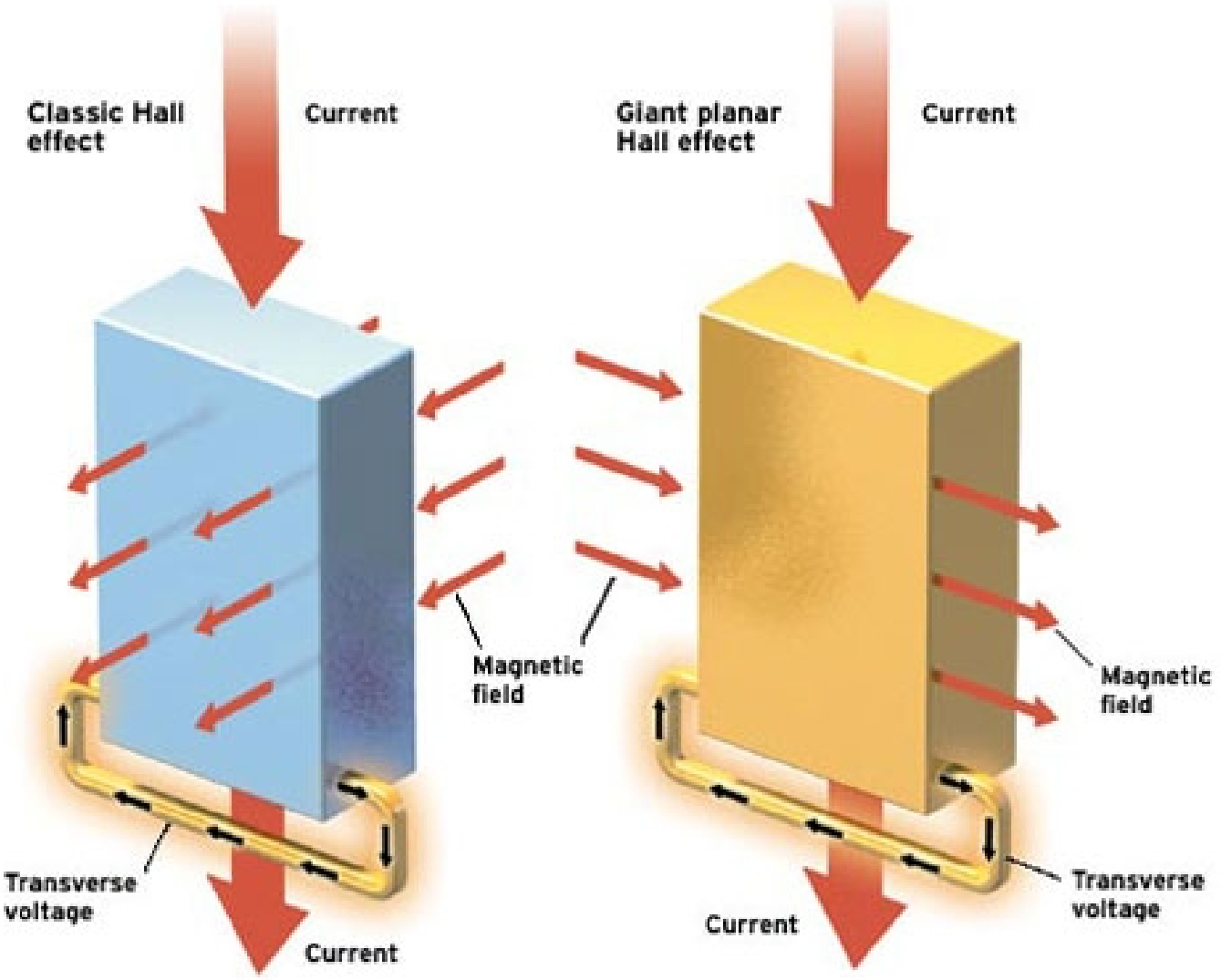
wmi.badw.de

Hall-Effekt



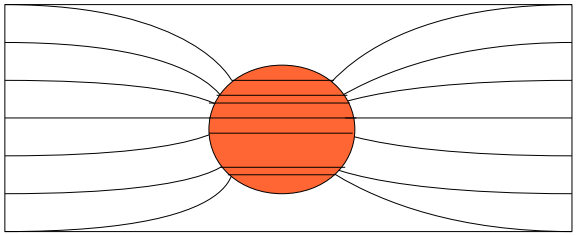
$$U_{hall} = A_{hall} \cdot \frac{I \cdot B}{d}$$

nach: elektro-wissen.de, wikipedia.org

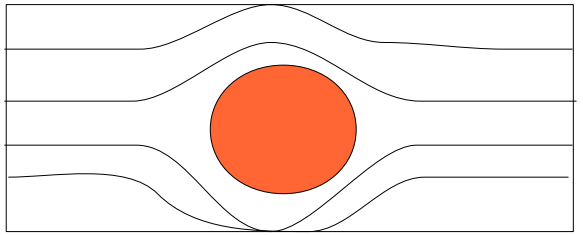


spectrum.ieee.org

EMR-Effekt

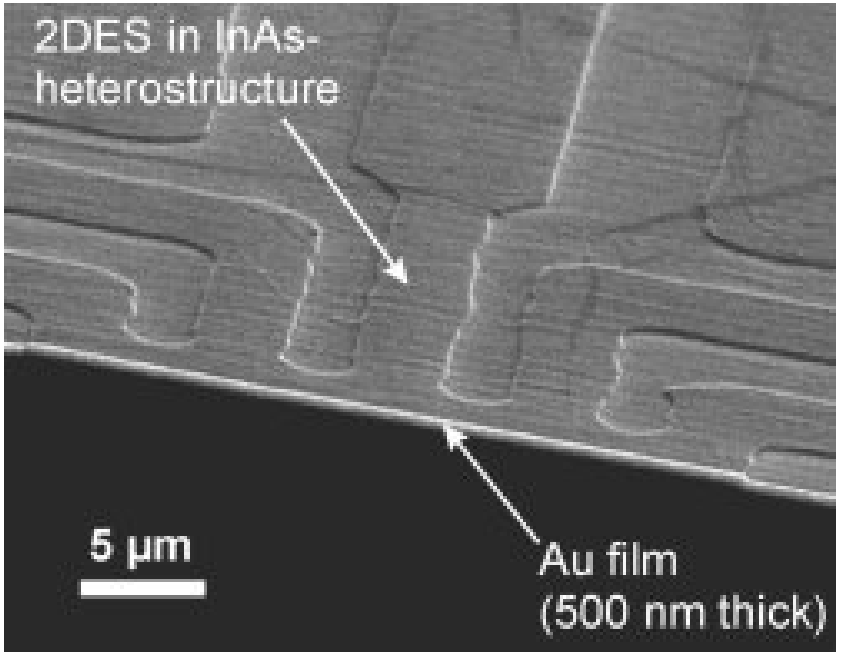


$B = 0 \qquad R = R_0$



$B \gg \mu^{-1} \quad R \gg R_0$

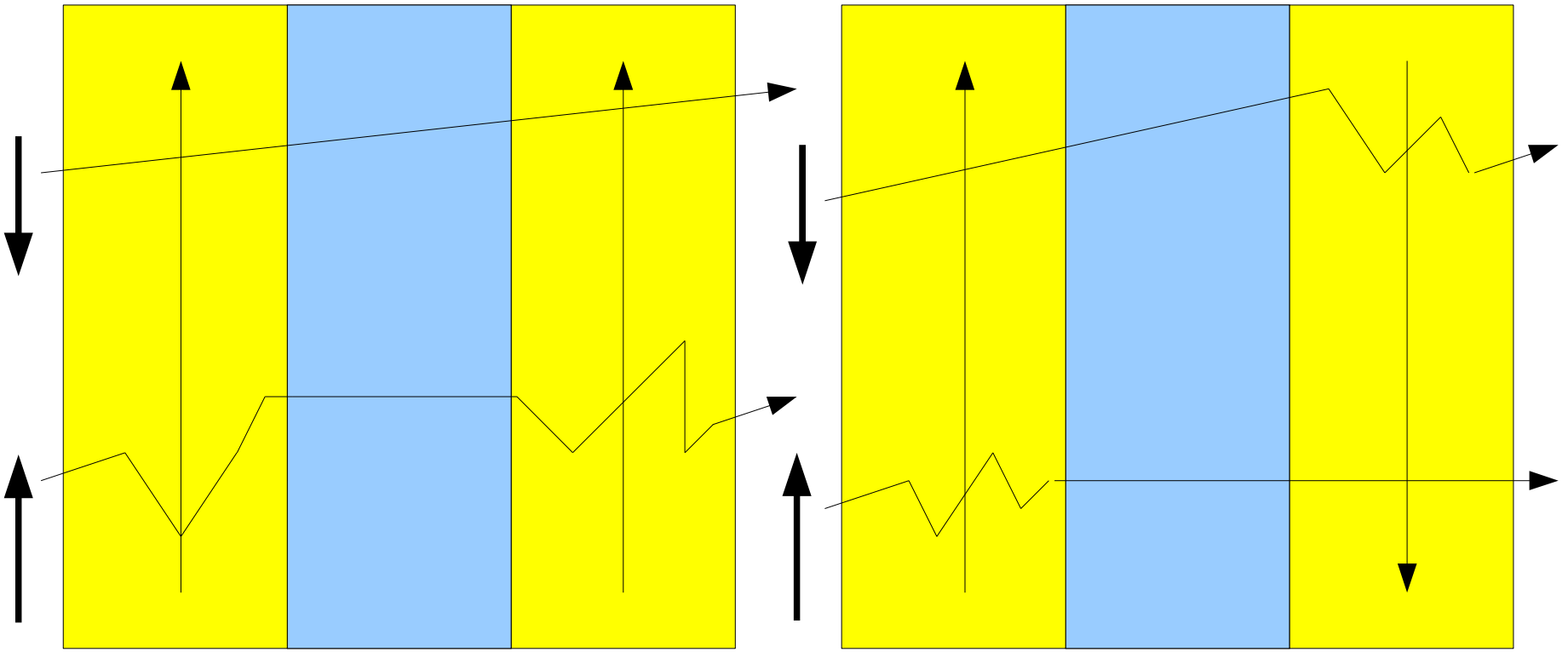
Kronenwerth:
Extraordinary Magneto-resistance Effekt: Metall-Halbleiter-Hybridstrukturen in homogenen und inhomogenen Magnetfeldern S.10



physnet.uni-hamburg.de

GMR-Effekt

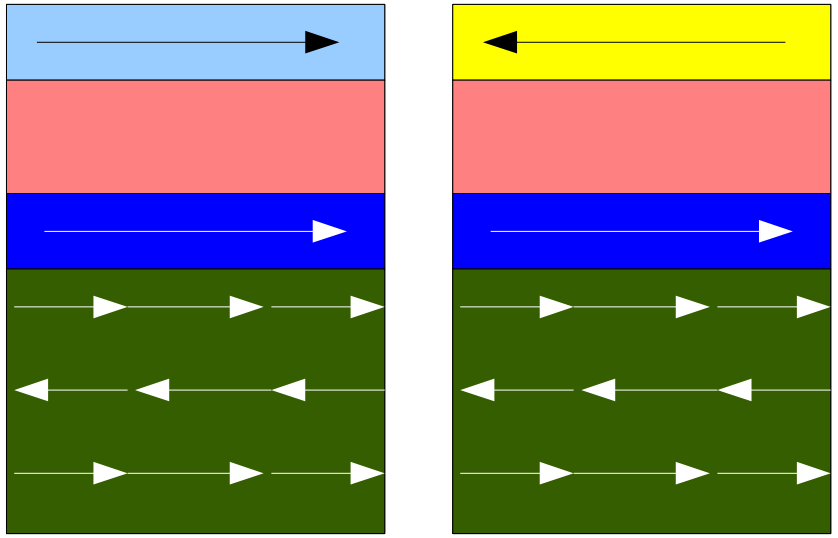
- beruht auf Spinabhängigkeit der Streuung
- abwechselnd FM- und nicht-FM-Schichten

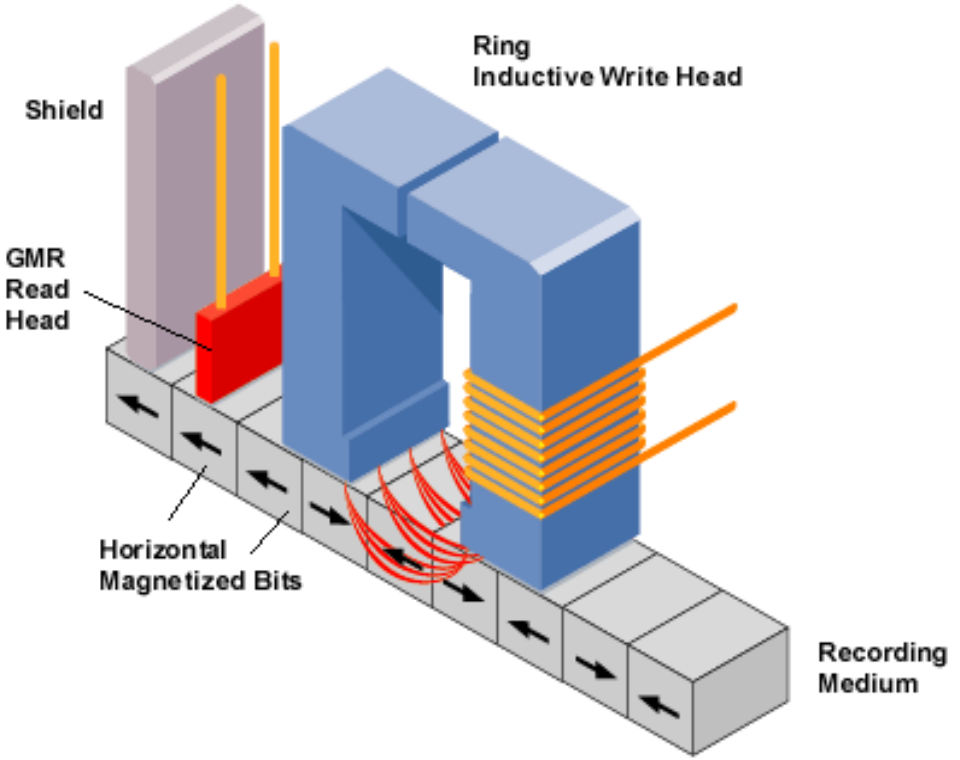


de.wikipedia.org

geringer Widerstand

hoher Widerstand

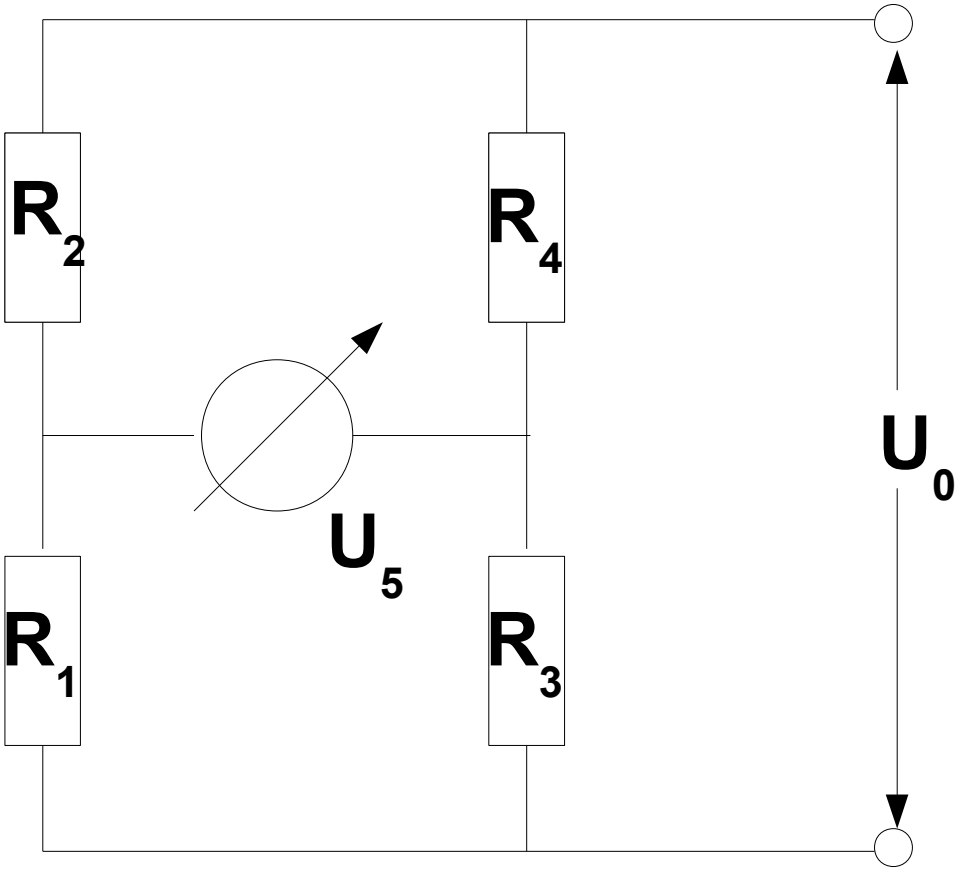




Stöhr, Siegmann:
Magnetism S.648

encyclopedia2.
thefreedictionary.com

Wheatstone'sche Messbrücke



$$\frac{U_1}{R_1} = \frac{U_0}{R_1 + R_2}$$

$$\frac{U_3}{R_3} = \frac{U_0}{R_3 + R_4}$$

$$U_5 = U_1 - U_3 =$$

$$U_0 \cdot \left(\frac{R_1}{R_1 + R_2} - \frac{R_3}{R_3 + R_4} \right)$$

$$= U_0 \cdot \frac{R_1 \cdot R_4 - R_3 \cdot R_2}{(R_1 + R_2) \cdot (R_3 + R_4)}$$

de.wikipedia.org

Vielen Dank für Ihre Aufmerksamkeit