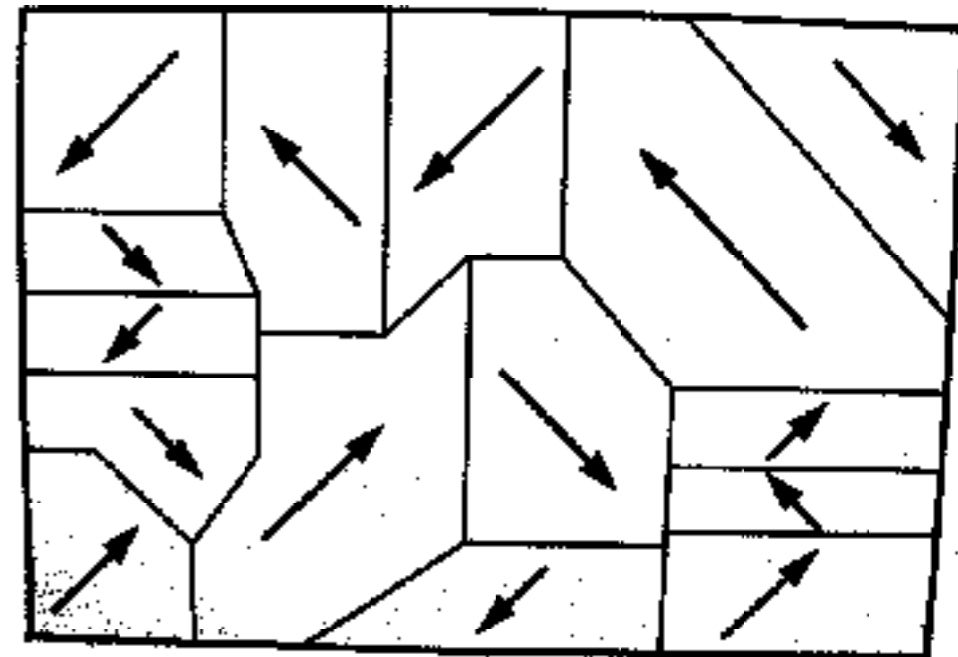
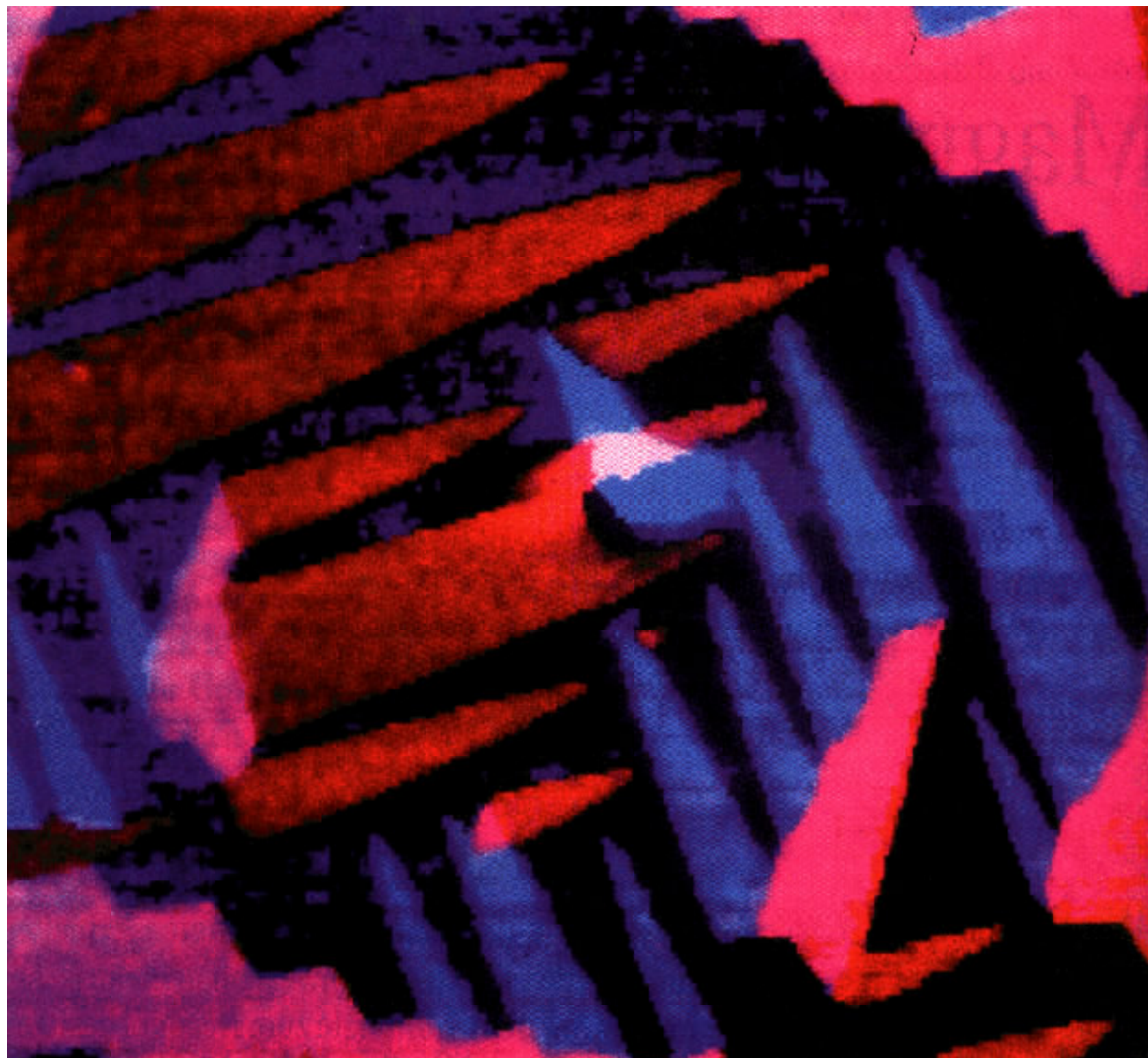


Weiß'sche Bezirke

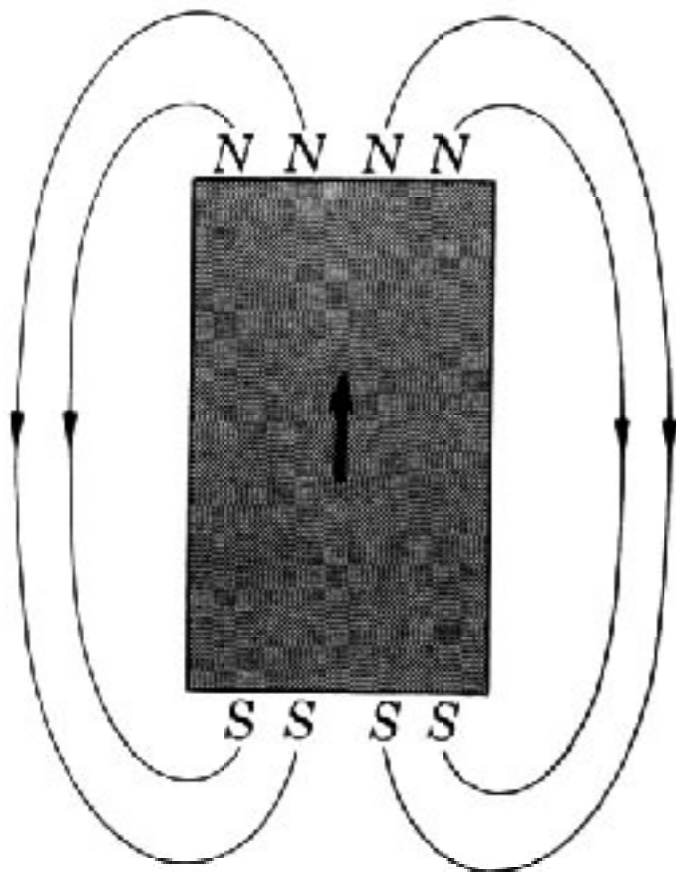
Magnetische Domänen im Polarisationsmikroskop



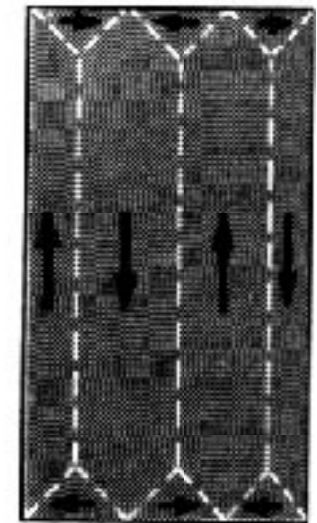
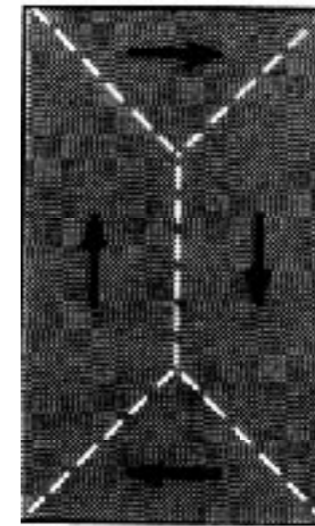
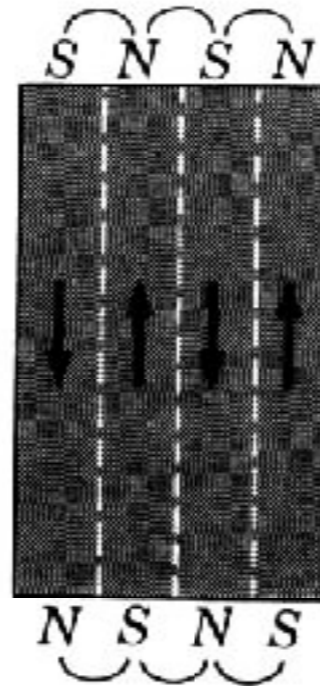
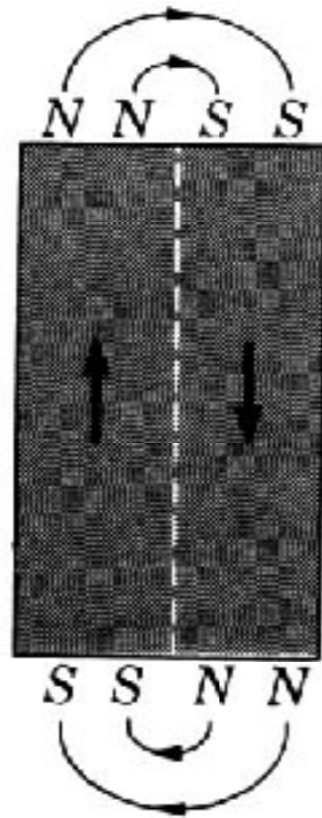
4 unterschiedliche
Magnetisierungsrichtungen

Magnetische Feldenergie

und Domänen

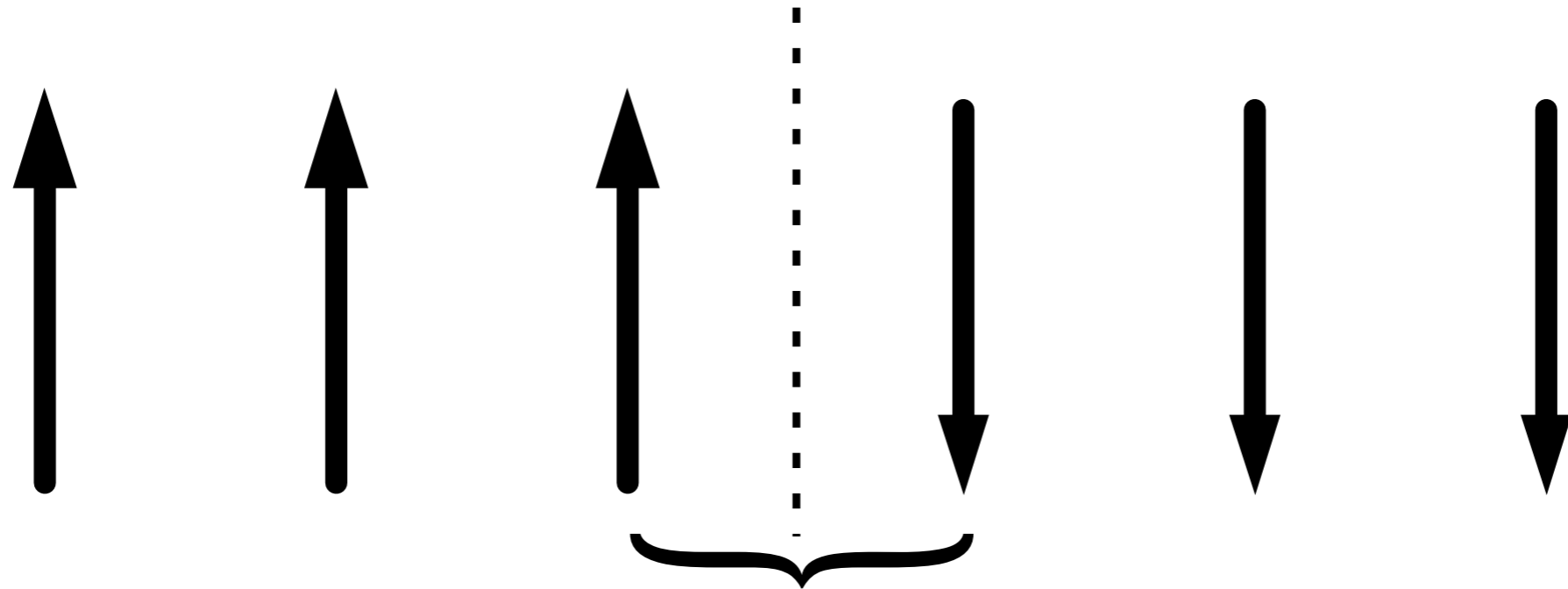


$$U = \int dV \mathbf{B} \cdot \mathbf{H}$$

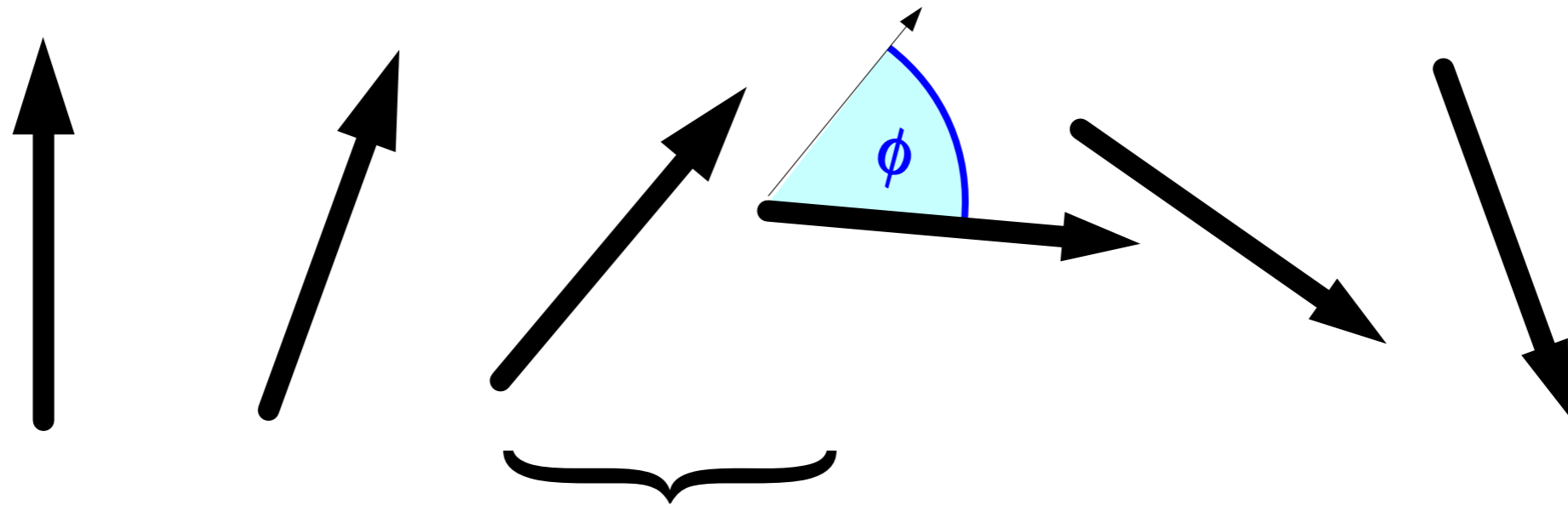


C. Kittel, *'Einführung in die Festkörperphysik'*, R. Oldenbourg, München

Energie der Domänengrenze

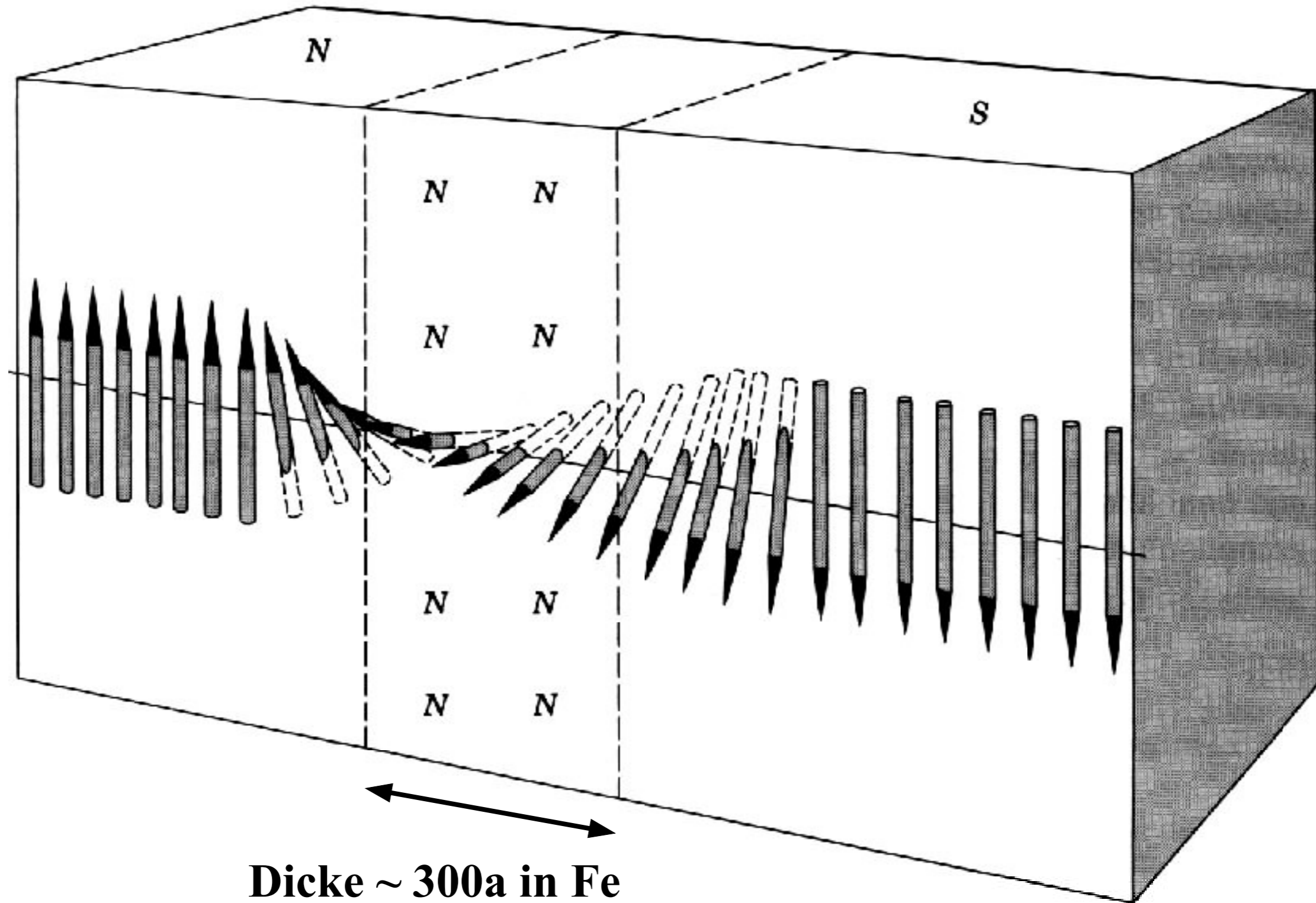


$$\Delta U = JS^2$$

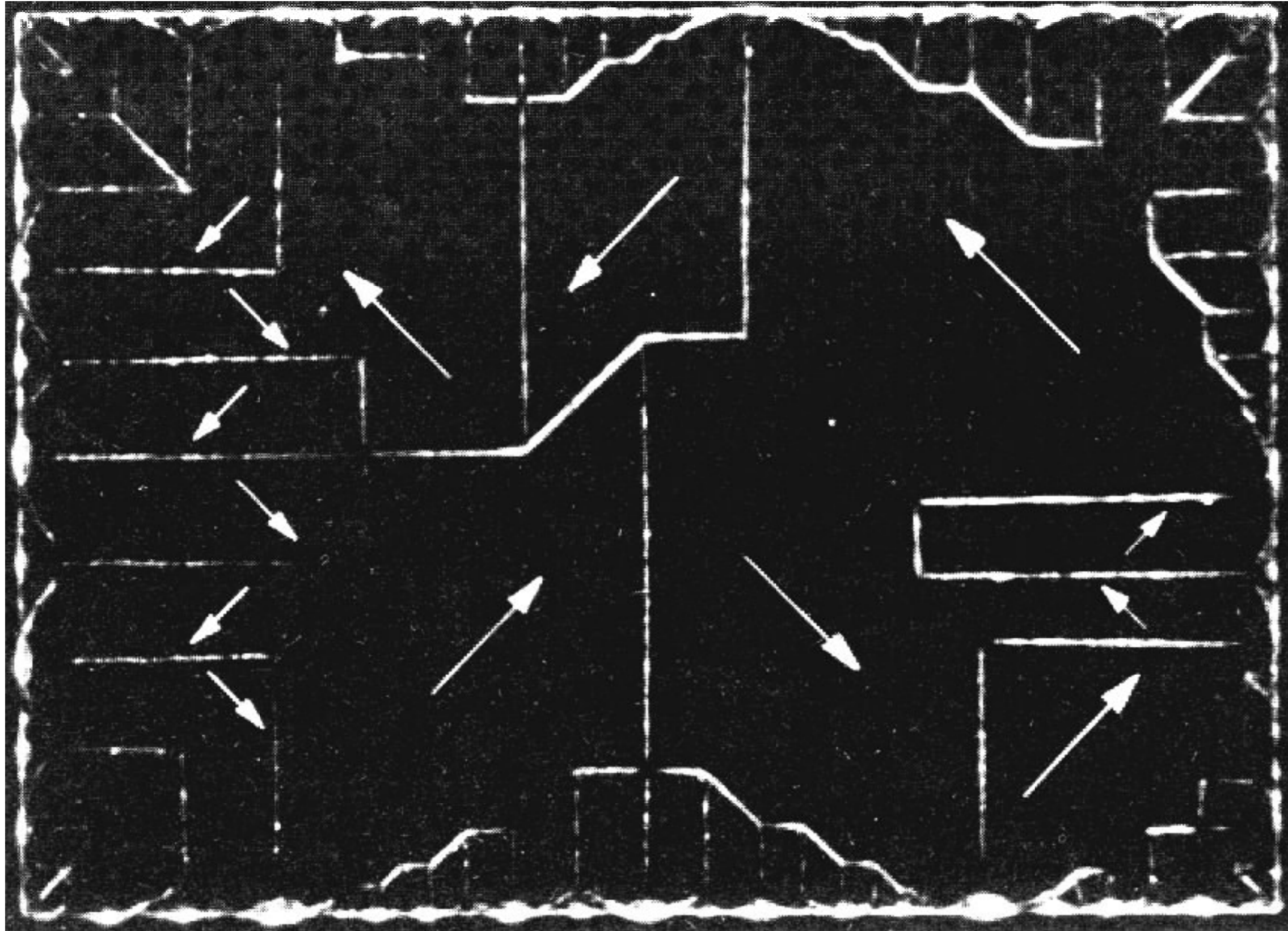


$$\Delta U = -JS^2 \cos^2 \phi$$

Bloch-Wand



Bevorzugte Orientierung der Domänen

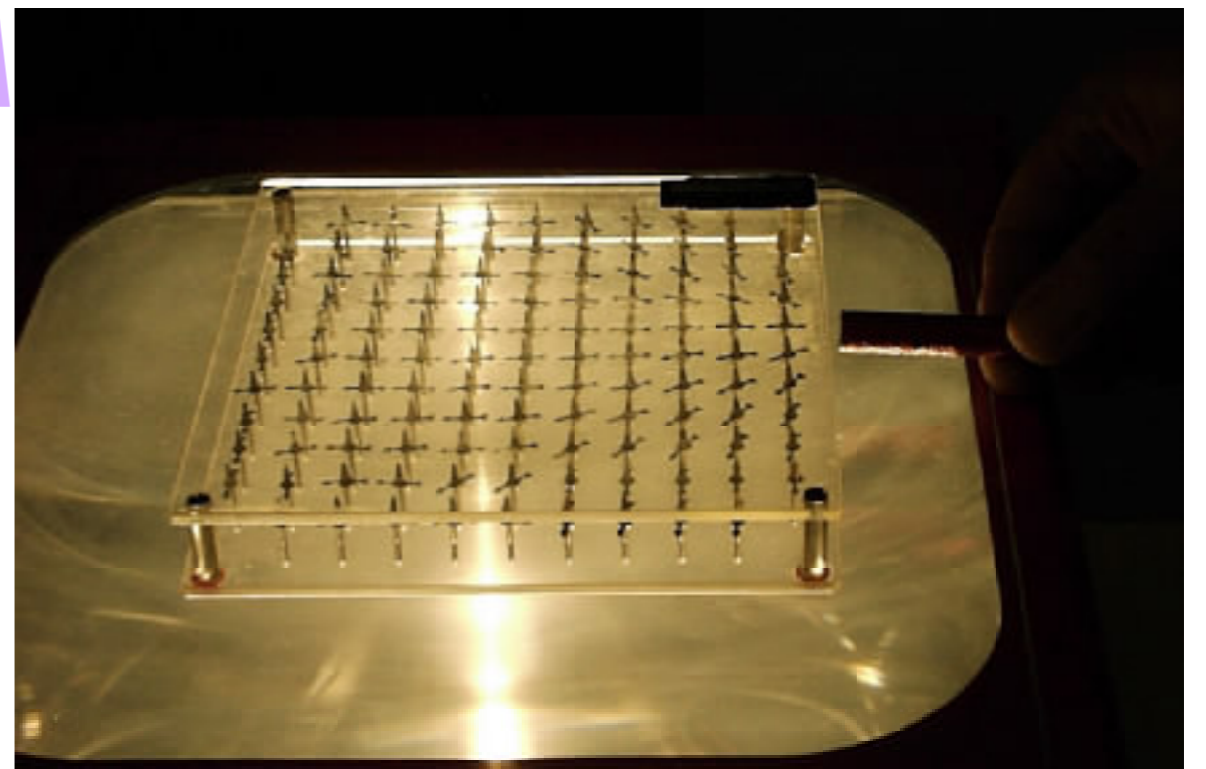
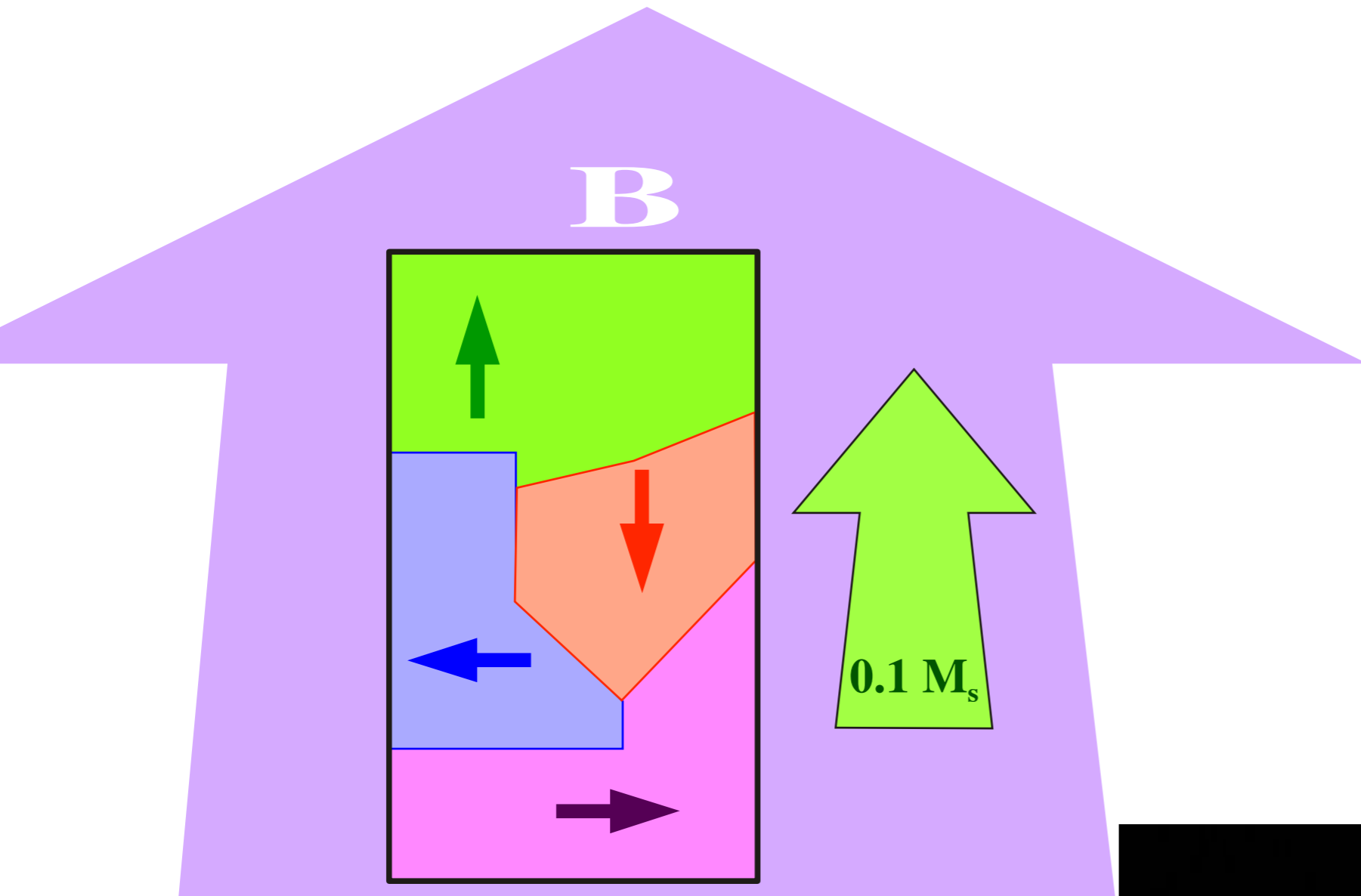


Ni

Ferromagnetische Domänen auf der Oberfläche eines einkristallinen Nickelplättchens. Die Domänengrenzen sind mit Hilfe der Bittertechnik sichtbar gemacht. Die Magnetisierungsrichtung innerhalb einer Domäne wird bestimmt, indem man wie in Bild 36a das Wachsen oder Schrumpfen der Domäne in einem äußeren Magnetfeld beobachtet. (Nach R. W. DeBlois.)

C. Kittel, 'Einführung in die Festkörperphysik', R. Oldenbourg, München

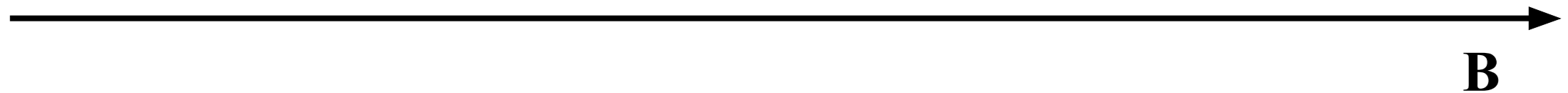
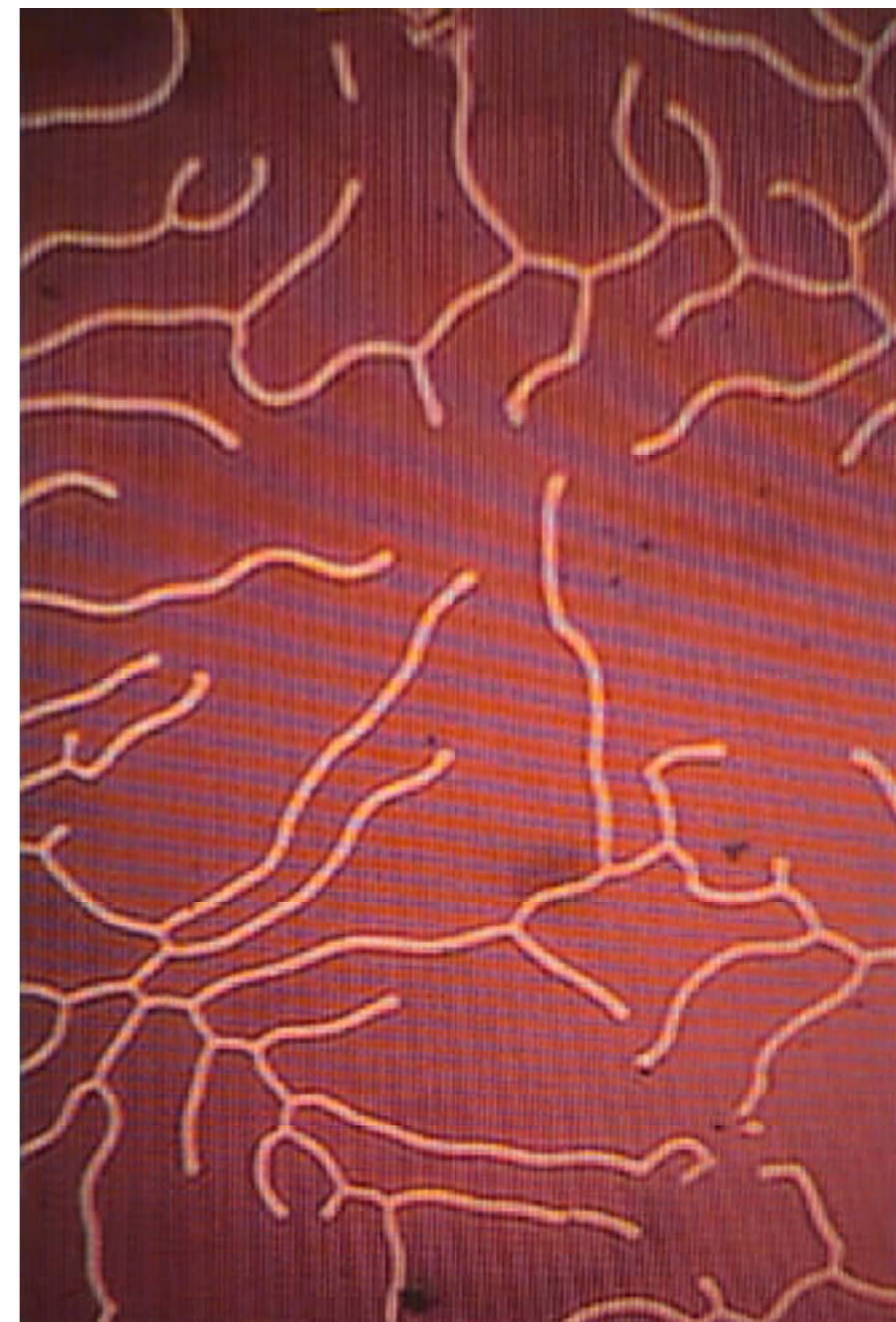
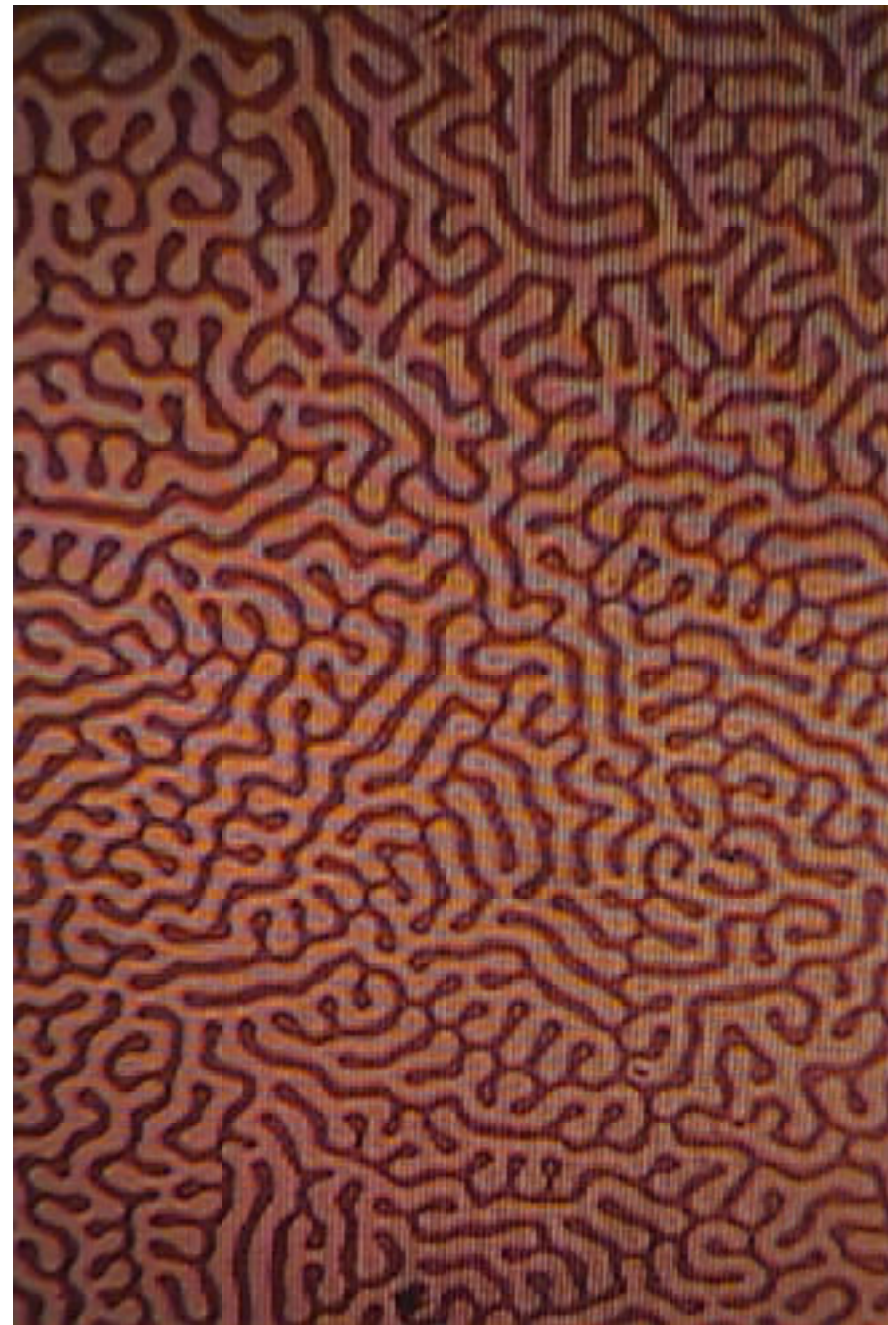
Domänen



Domänen im Magnetfeld

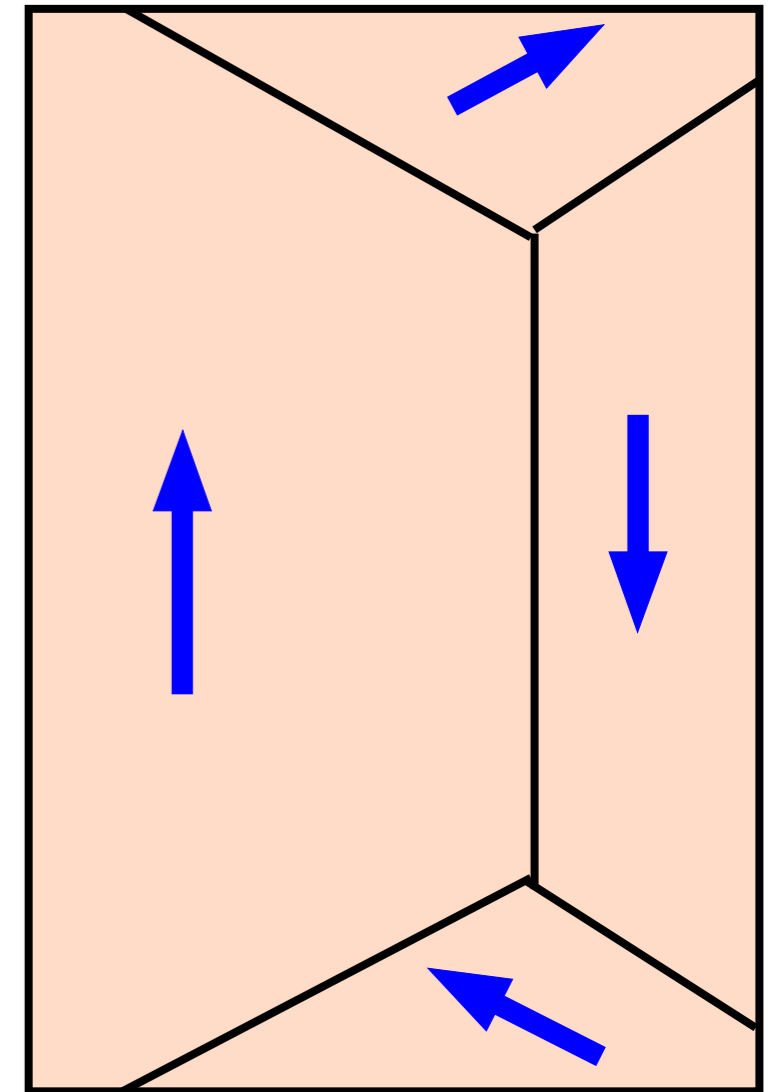
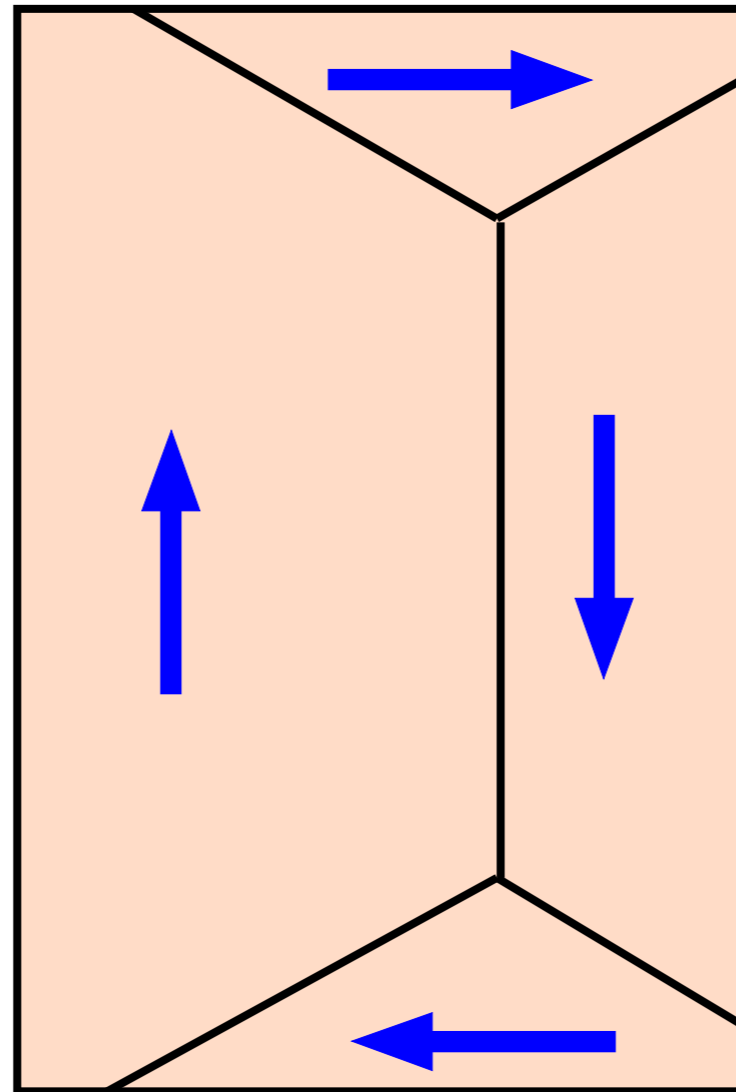
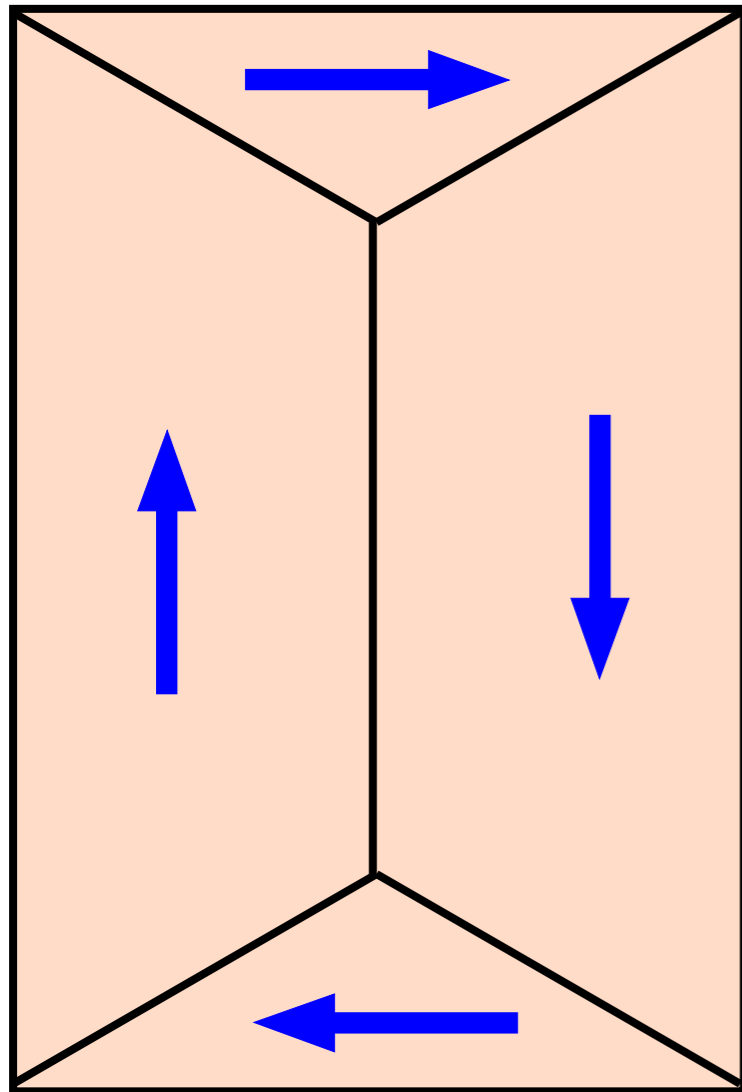
Wanderung der Domänengrenzen in einem Magnetfeld

Dünnes Ferritplättchen im Polarisationsmikroskop



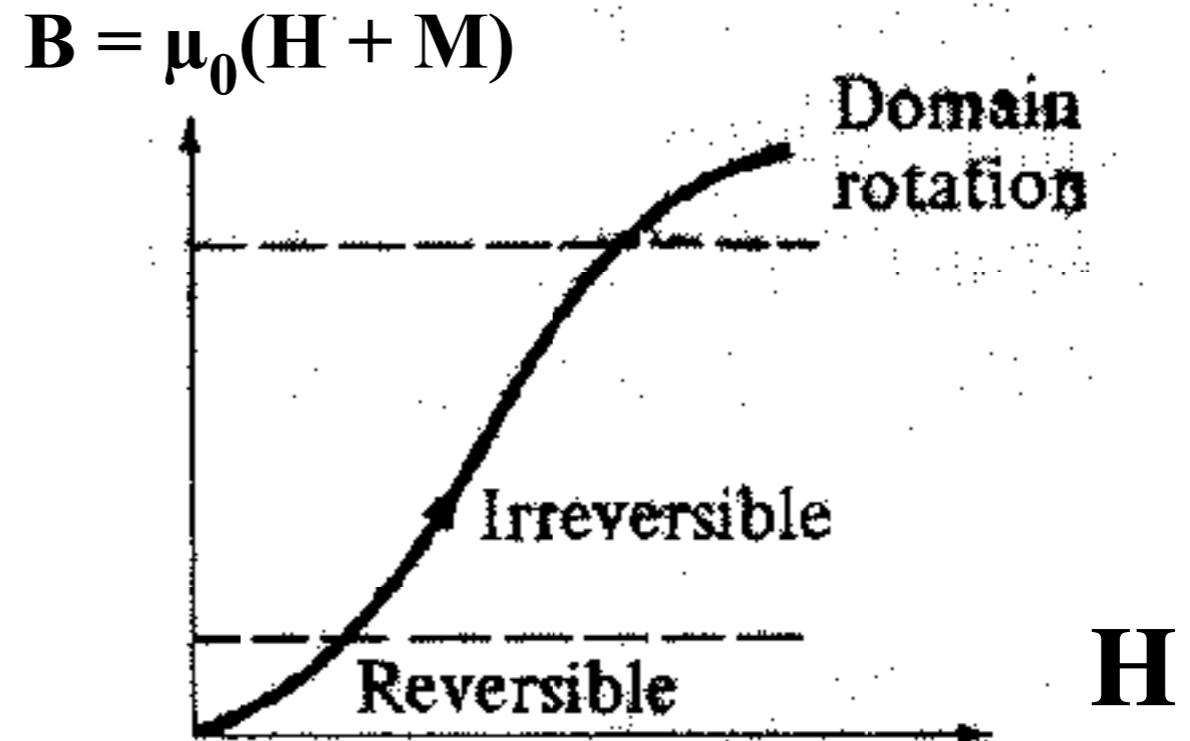
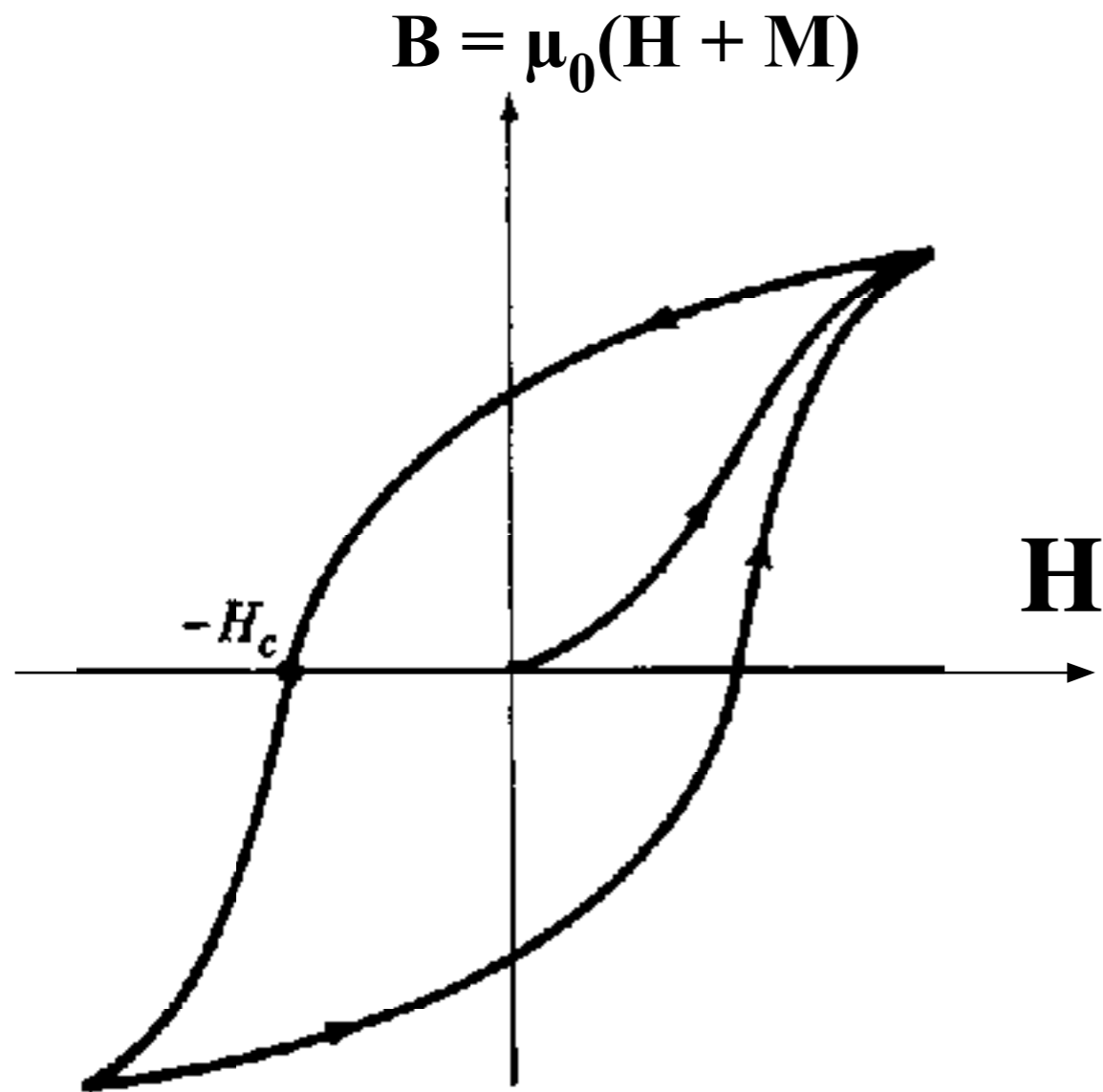
Wanderung von Domänengrenzen

im äußeren Feld



Stärke des Magnetfeldes

Irreversibilität



N.W. Ashcroft and N.D. Mermin, 'Solid state physics',
Holt, Rinehart and Winston, New York (1976).

Ferromagnetismus

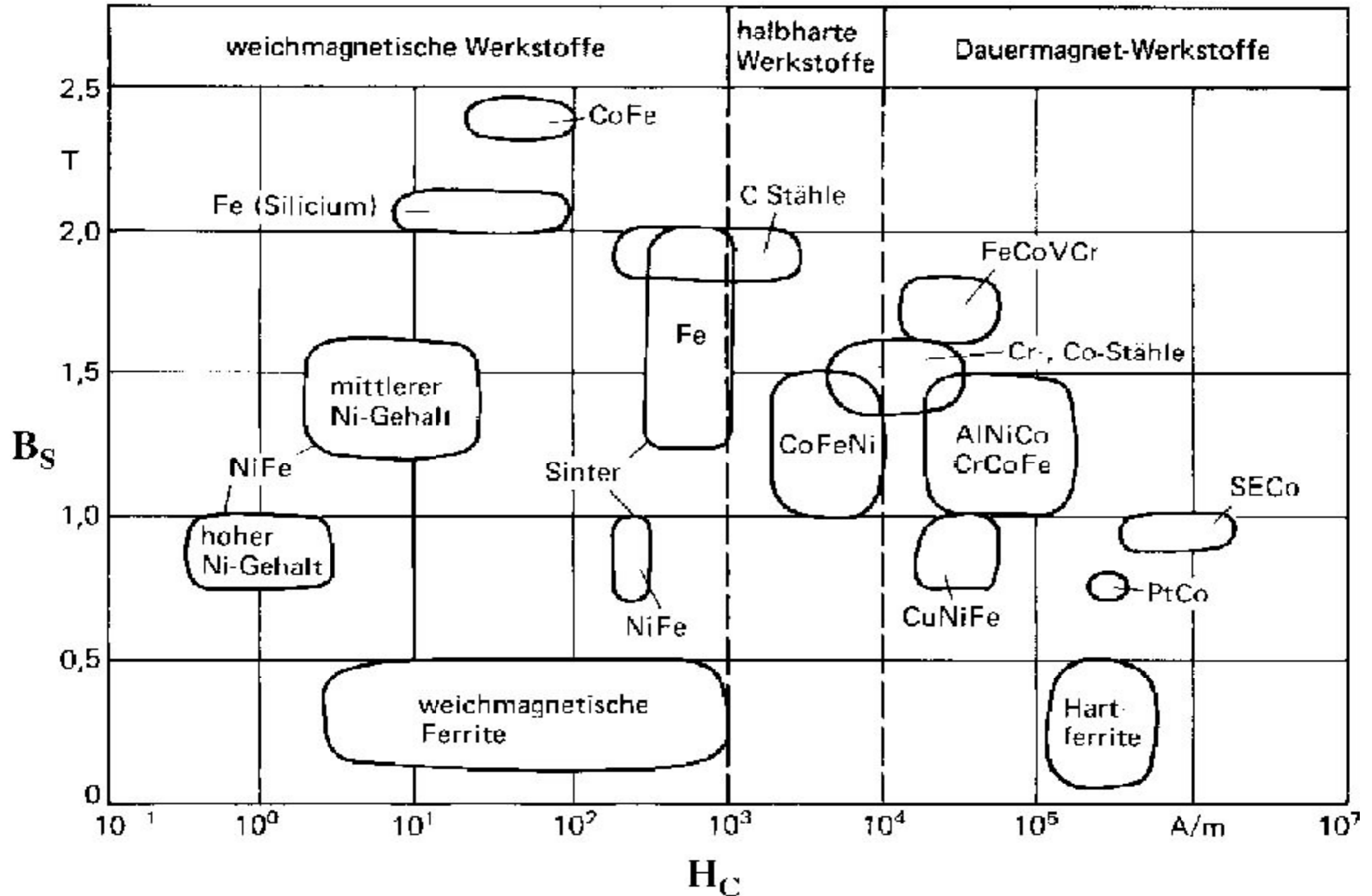
Suszeptibilität		Curie-Temperatur	
	μ_r		T_c / K
Ferrite	1000	Dy	87
Fe (rein)	10000	Gd	289
Co	1400	Cu ₂ MnAl	603
Ni-Fe (μ -Metall)	< 90000	Ni	631
		Fe	1042
		Co	1400

Remanenz und Koerzitivfeld

	B_r / T	$H_c / A/m$
C-Stahl	1	3600
Cr-Stahl	0.95	5000
AlNiCo Stahl	1.25	44000
Co-Stahl	0.95	19000
seltene Erden	0.9	700000

Magnetische Werkstoffe

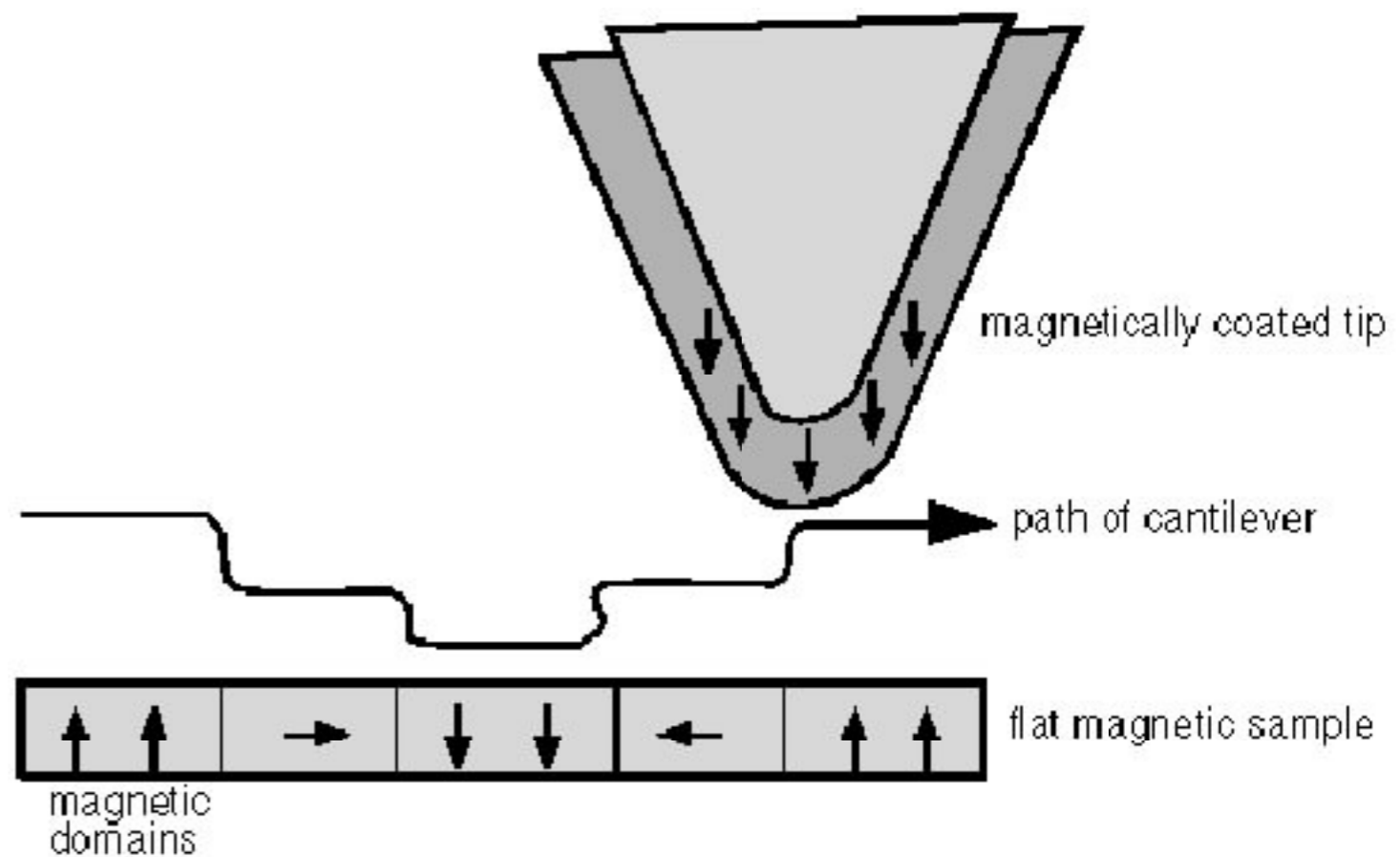
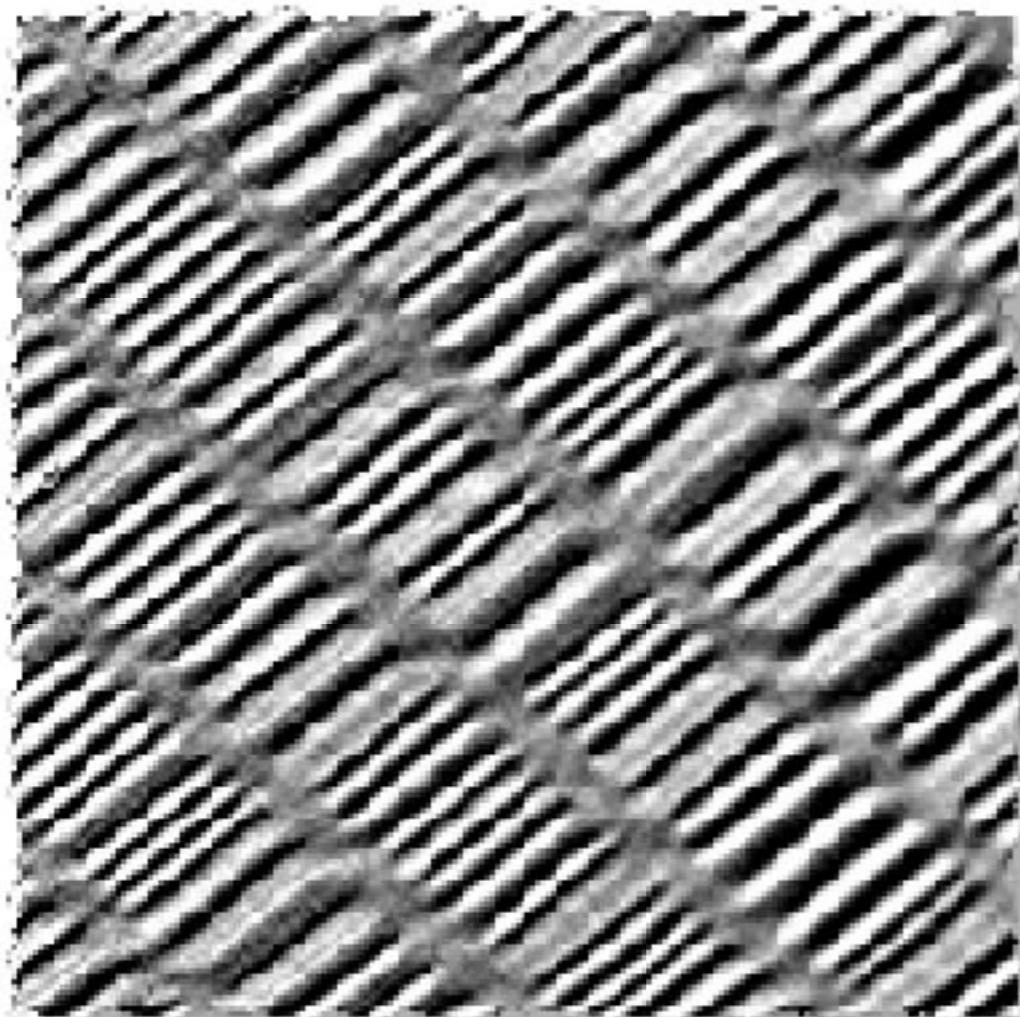
E. Hering, R. Martin, and M. Stohrer, 'Physik für Ingenieure', VDI Verlag, Düsseldorf (1989).



Magnetische Nanostrukturen



Abbildung:
magnetische Kraftmikroskopie



Biomagnetismus

Weak Magnetic Fields



Earth field →

Environmental fields

Urban noise →

Car @ 50 m →

Flux-gate magnetometer

Transistor chip @ 2 m →

Transistor die @ 1 m →

SQUID

B (Tesla)

10^{-4}

10^{-5}

μT

10^{-6}

10^{-7}

10^{-8}

nT

10^{-9}

10^{-10}

10^{-11}

10^{-12}

pT

10^{-13}

10^{-14}

10^{-15}

Biomagnetic fields

← Lung particles

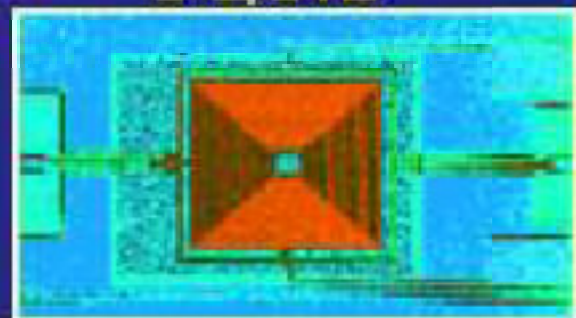
← Human heart

← Fetal heart

← Human eye

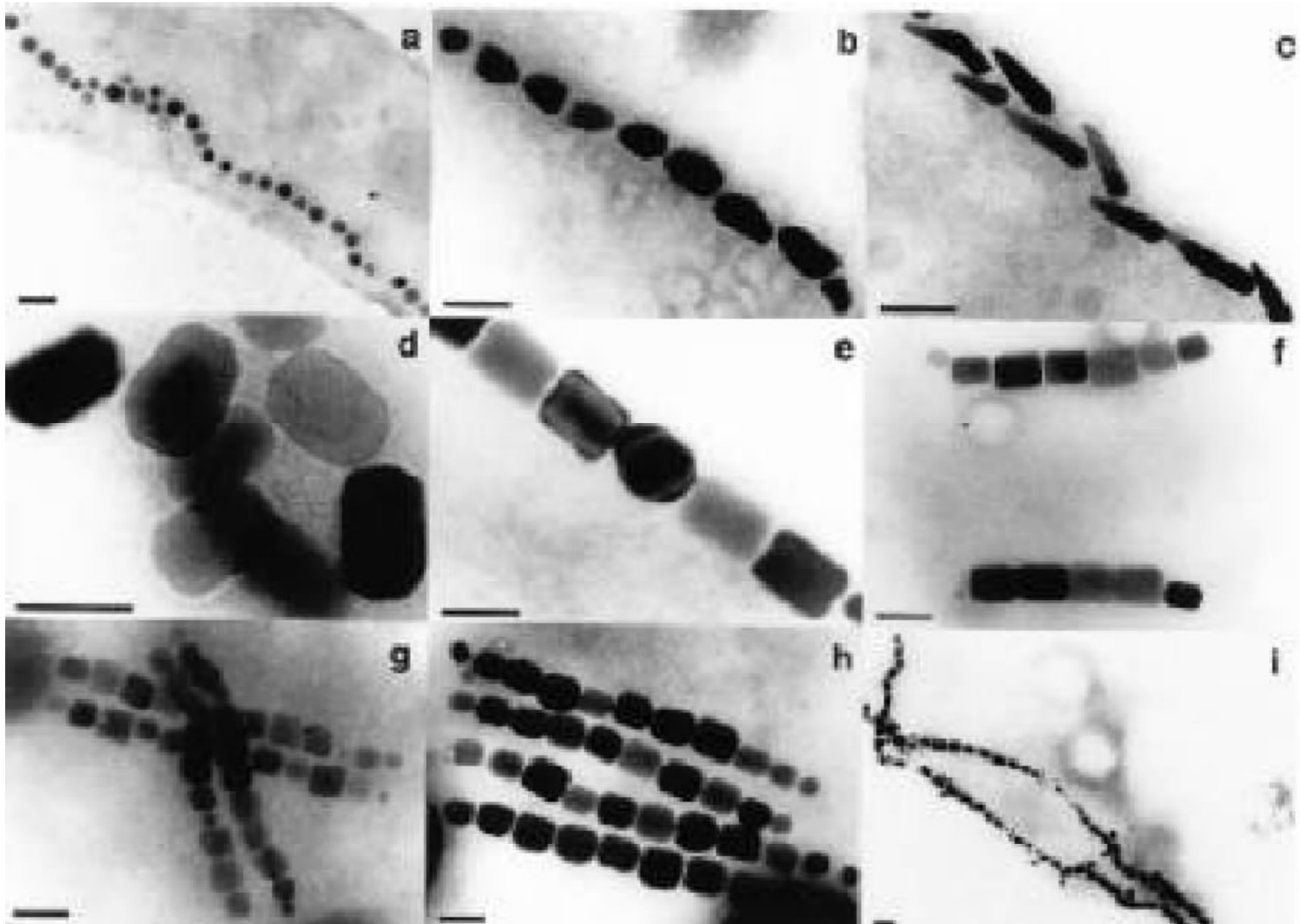
← Human brain (α)

← Human brain (response)



Magnetotaktische Bakterien

Magnetische Nanopartikel



Magnetostraktion

positive Magnetostraktion

ohne Feld

mit Feld



negative Magnetostraktion

ohne Feld

mit Feld

