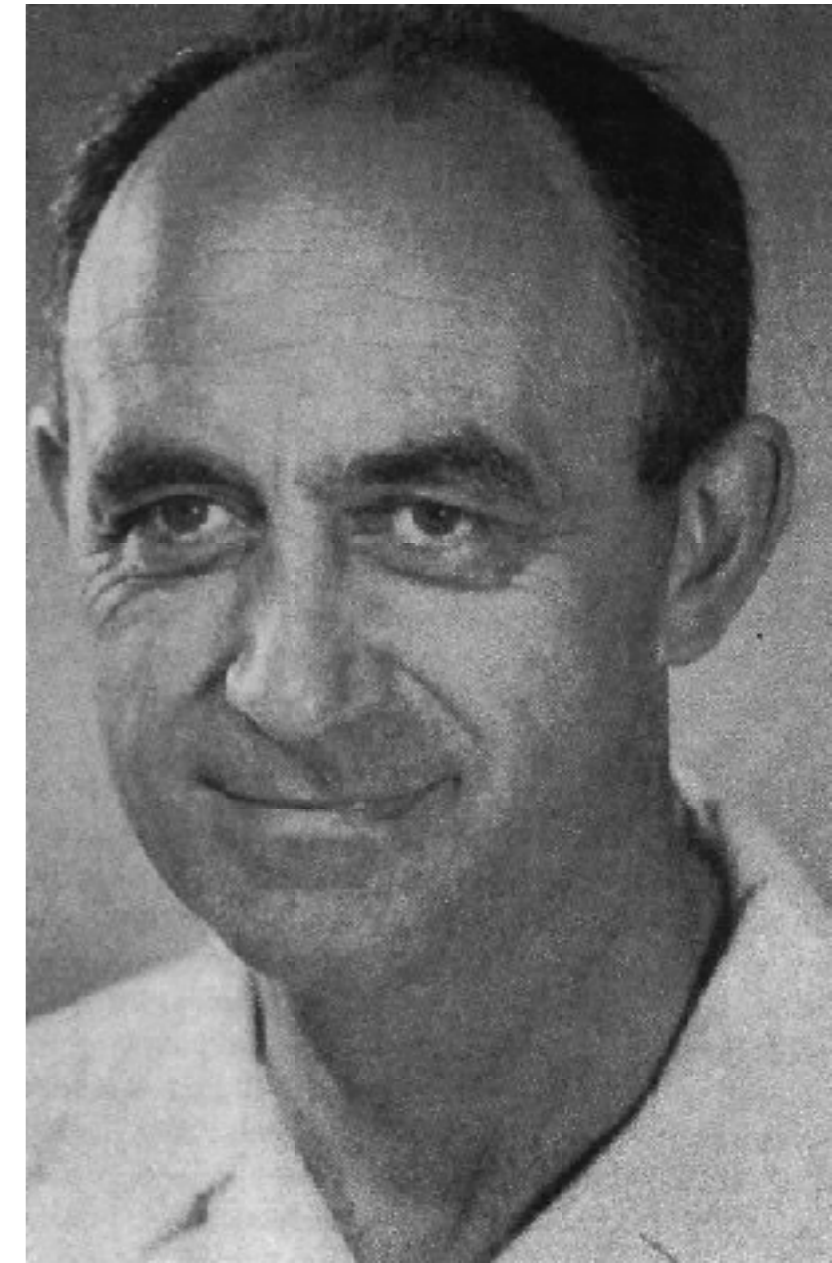


Fermi-Energie $\mathcal{E}_F = \frac{\hbar^2}{2m} \left(\frac{3}{V} \frac{2N}{\pi^2} \right)^{2/3}$

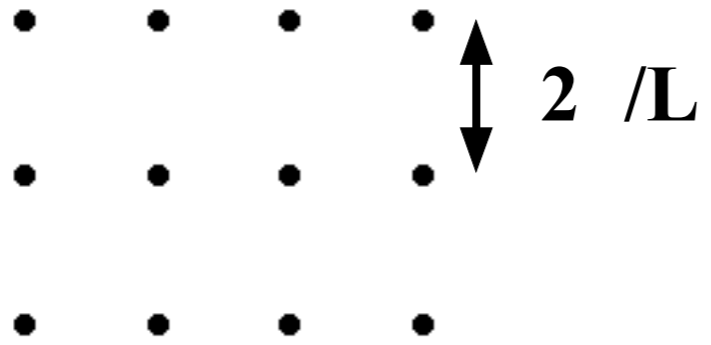
Fermi-Impuls $\hbar k_F = \hbar \left(\frac{3}{V} \frac{2N}{\pi^2} \right)^{1/3}$

Fermi-Geschwindigkeit $v_F = \hbar k_F / m$

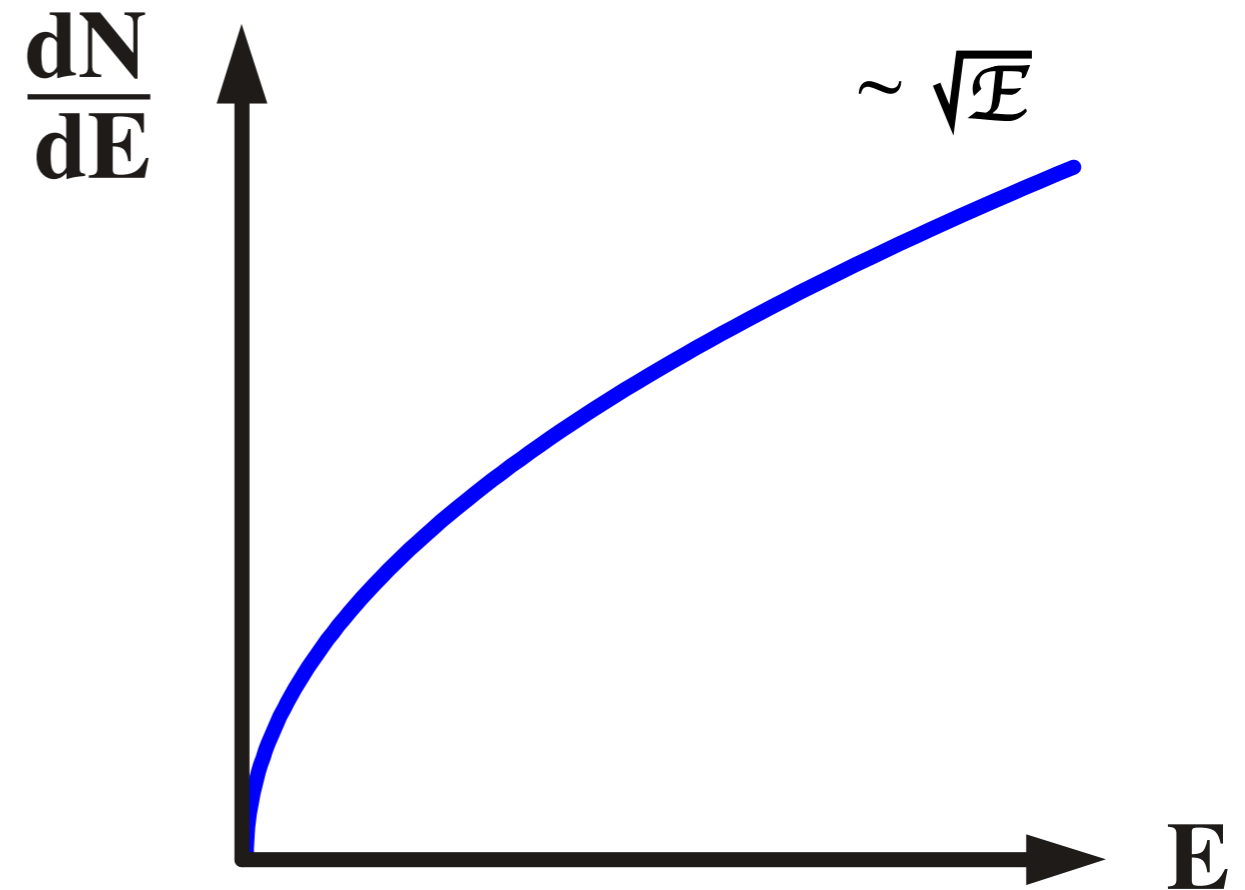
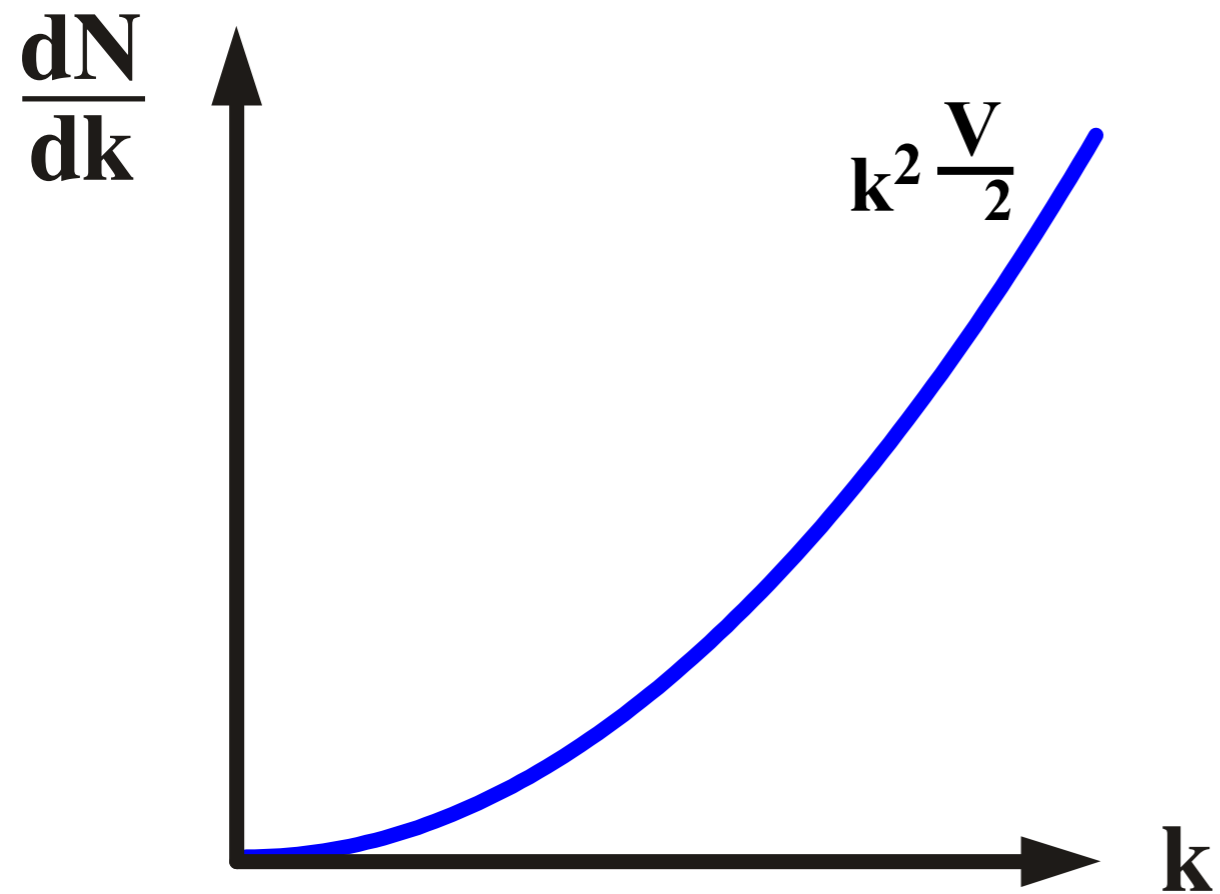
Fermi-Temperatur $T_F = \mathcal{E}_F / k_B$



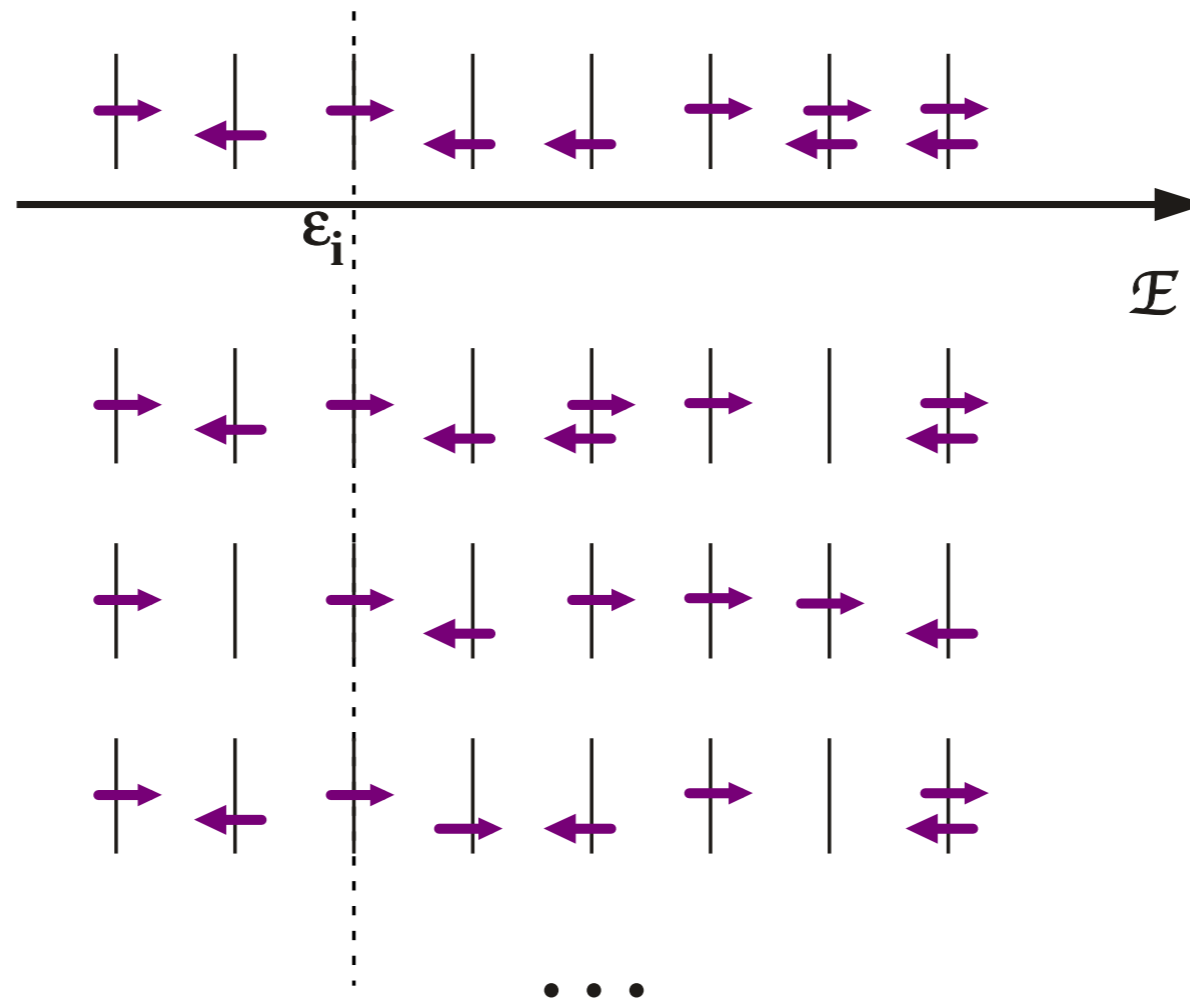
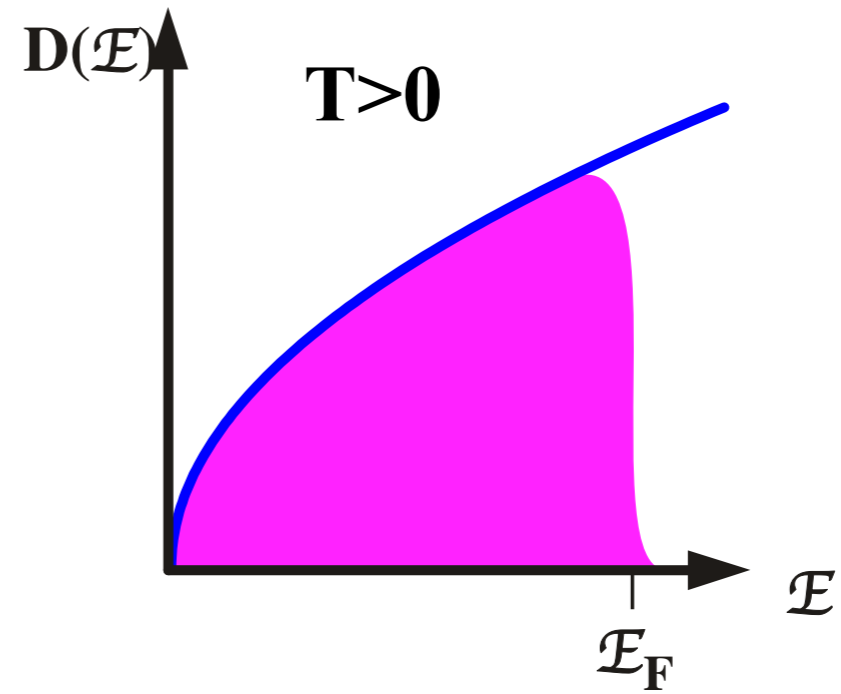
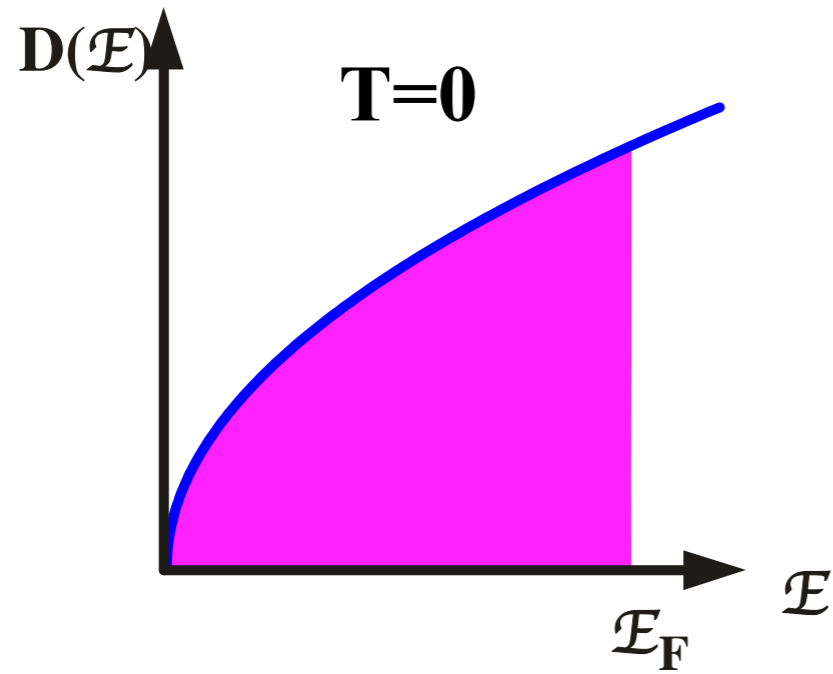
Zustände im k-Raum



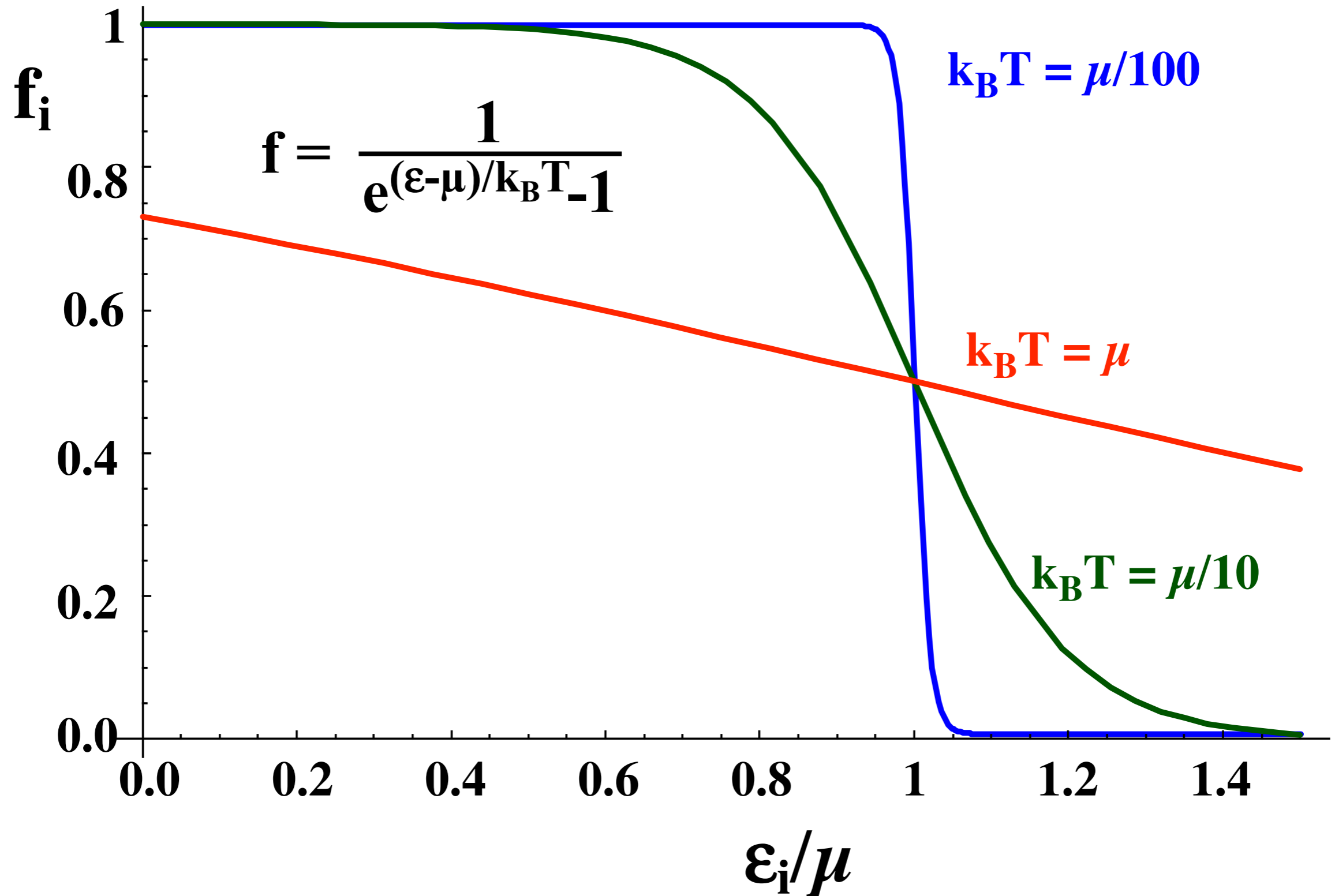
Zustandsdichte



Besetzte Zustände



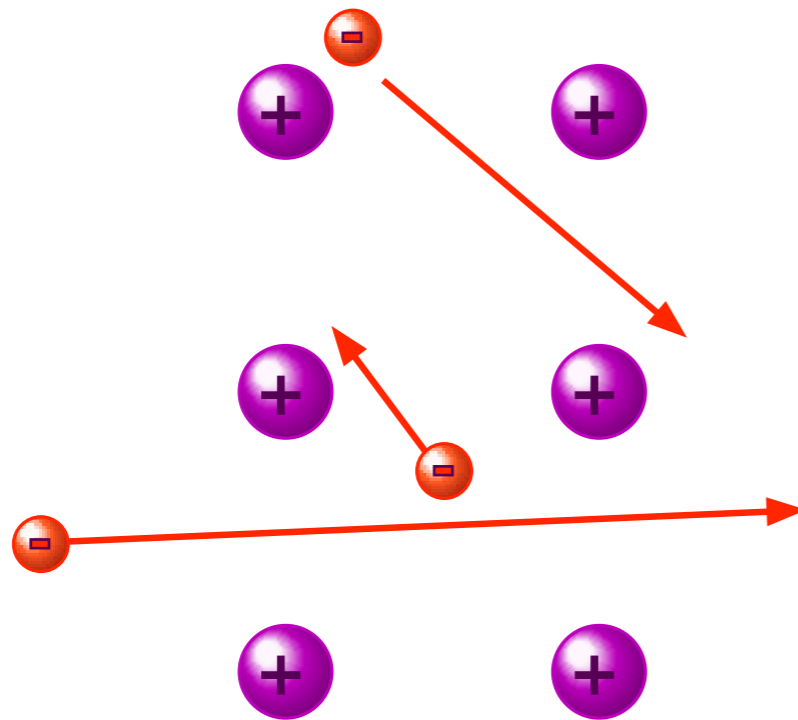
Fermi-Dirac Verteilung



Wärmekapazität

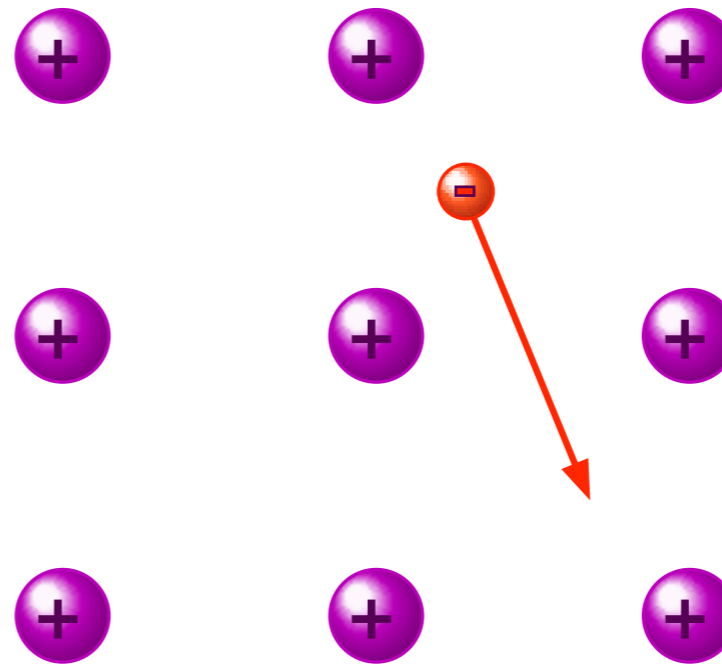
Valenzelektronen:

- ballistische Bewegung
- kurze Stöße



Atomrümpfe:

- klein
- statisch



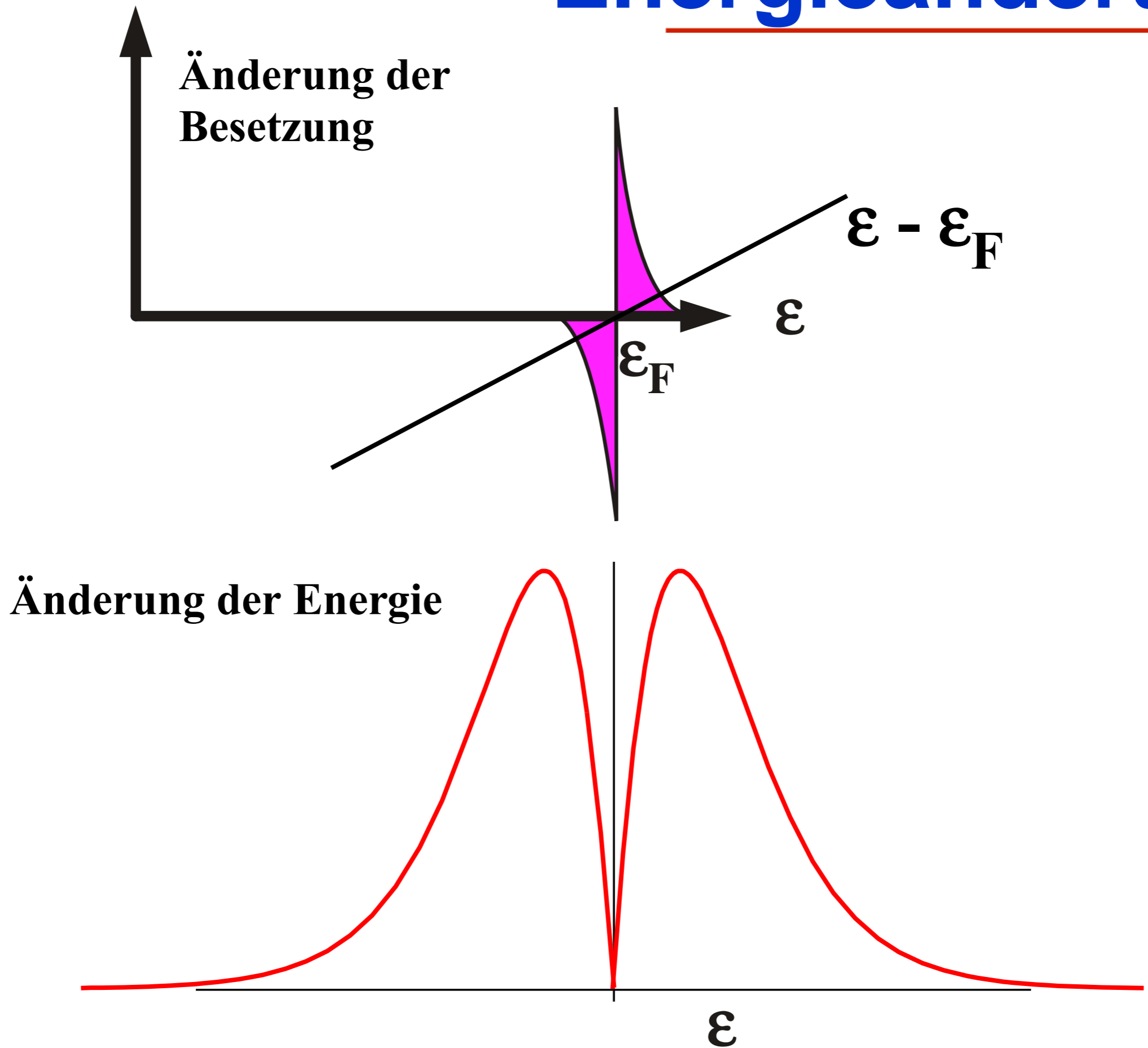
**ideales
Gas**

Klassisch $c_v = 3R/2$

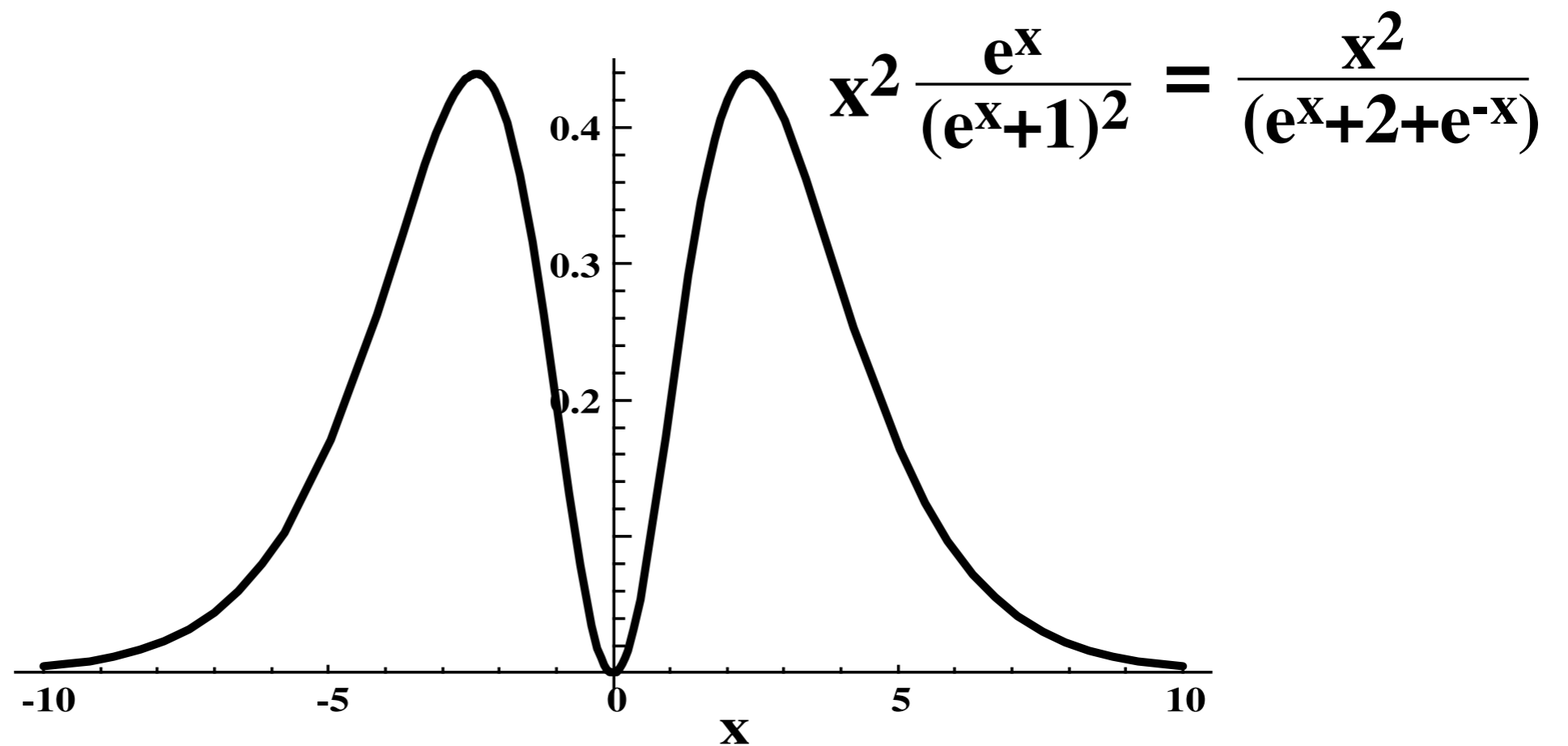
Elektronen: - $c_v < 3R/100$

- temperaturabhängig

Energieänderung

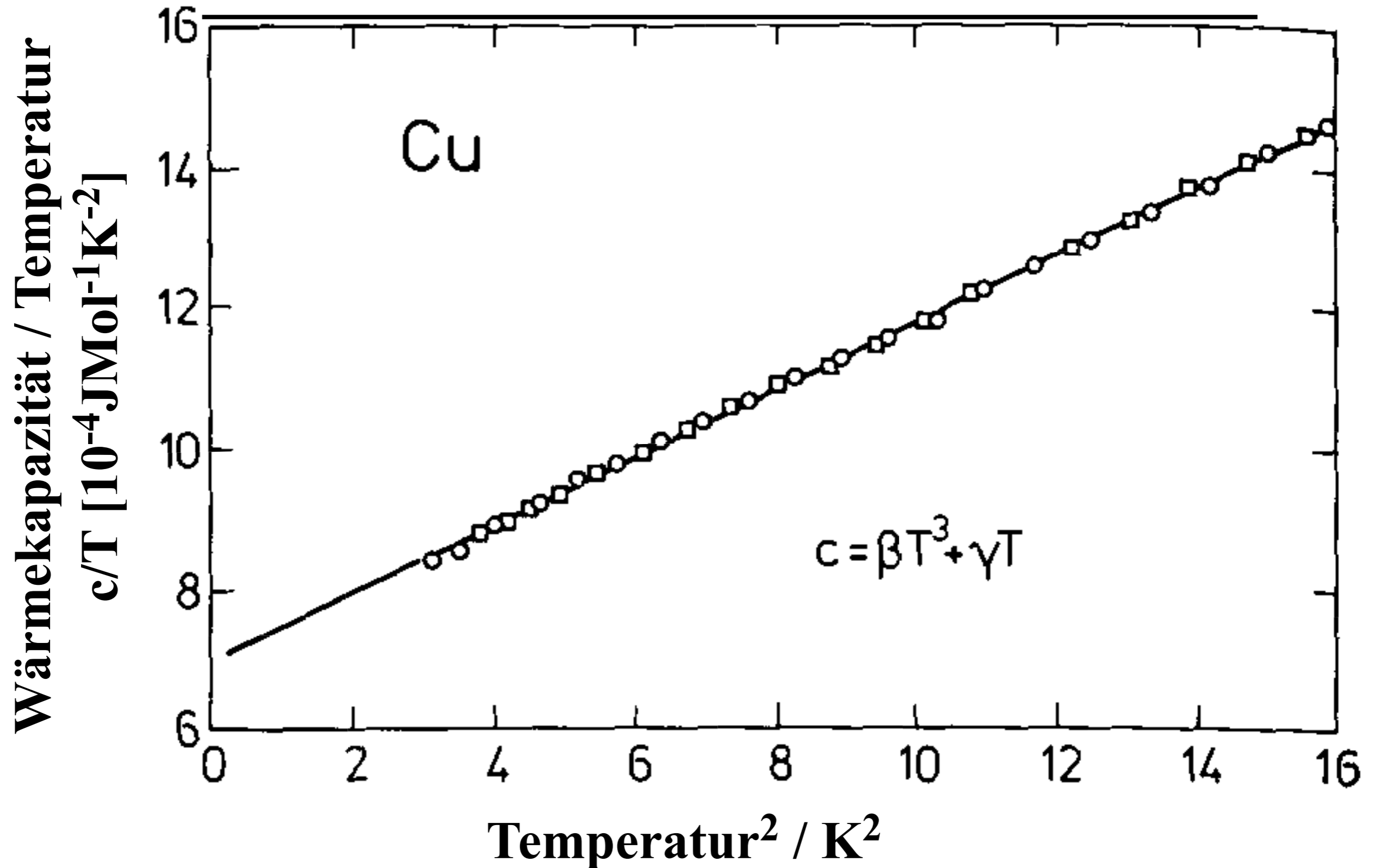


Energieänderung

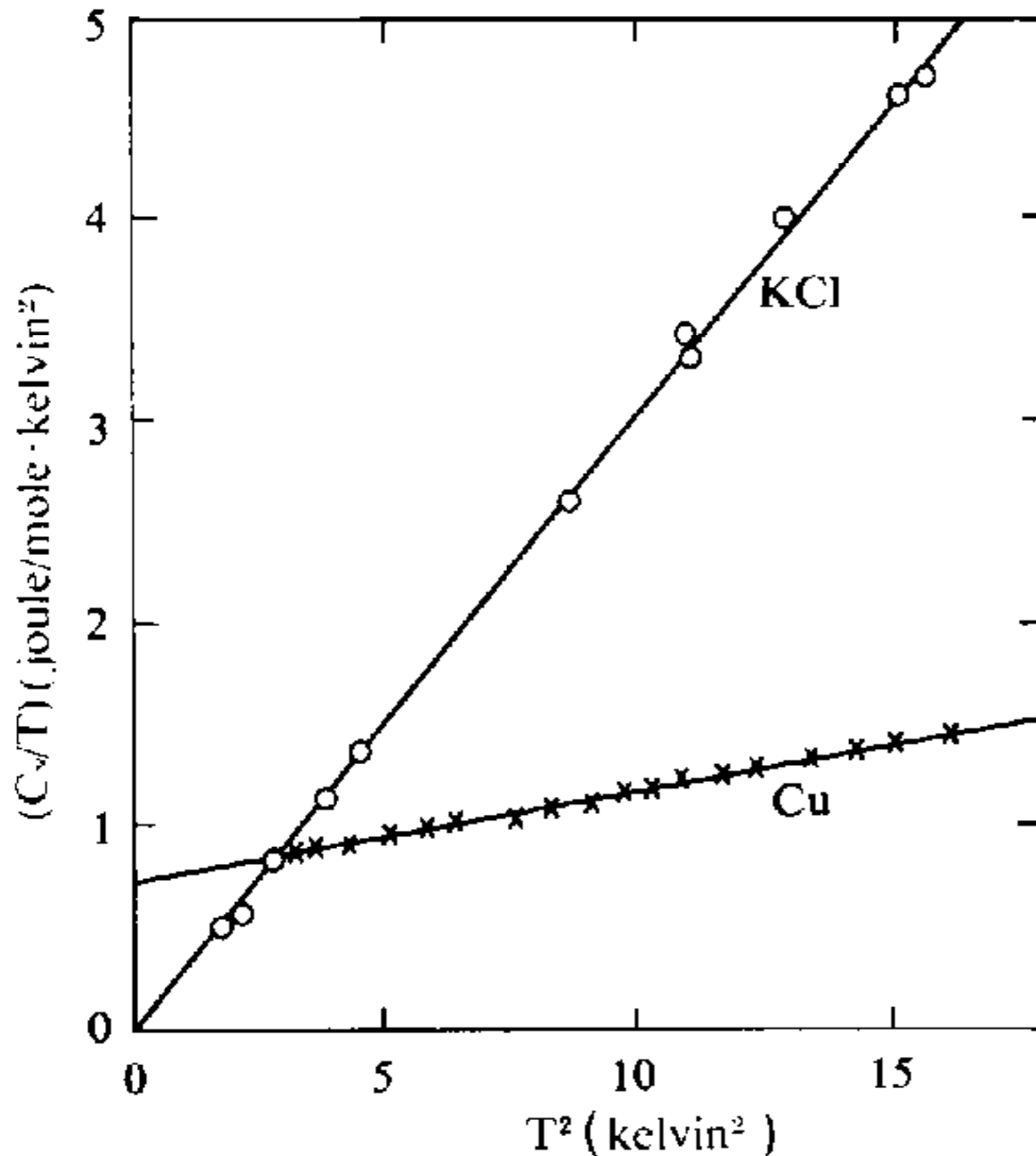


Wärmekapazität

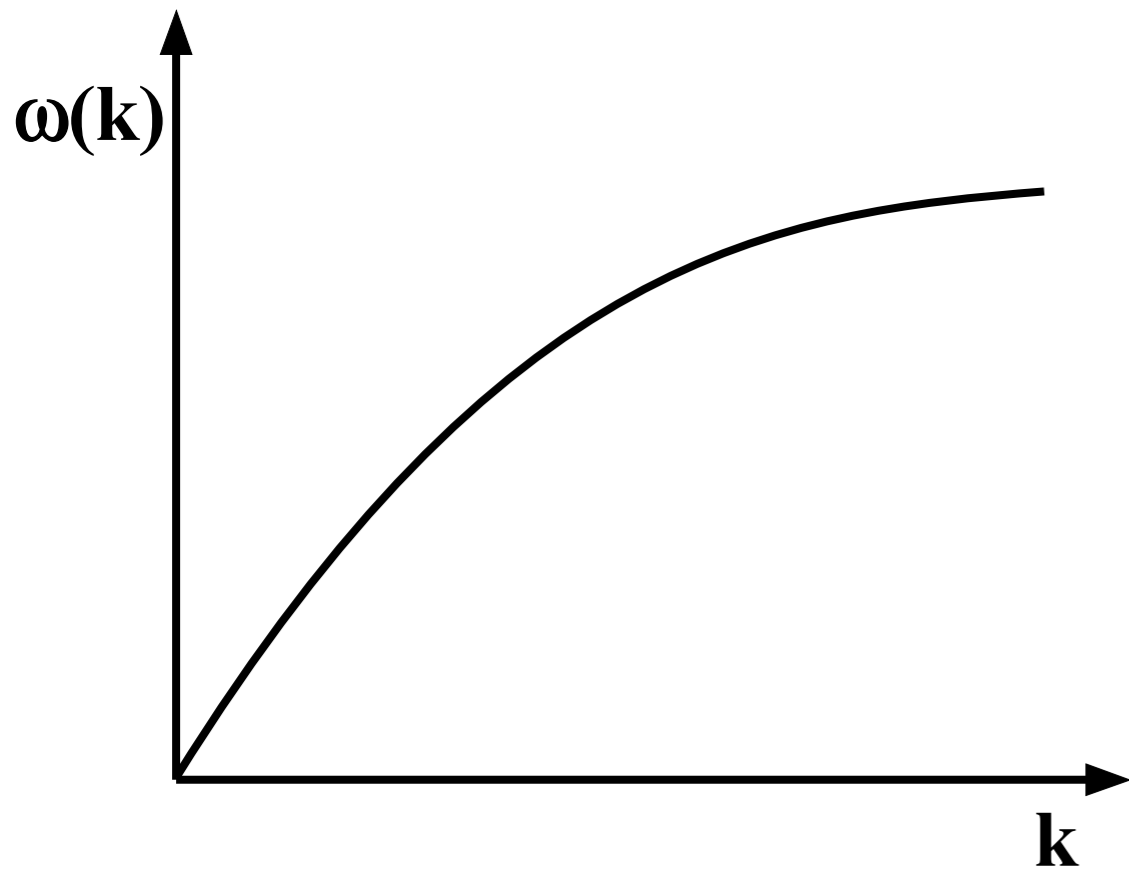
bei tiefen Temperaturen



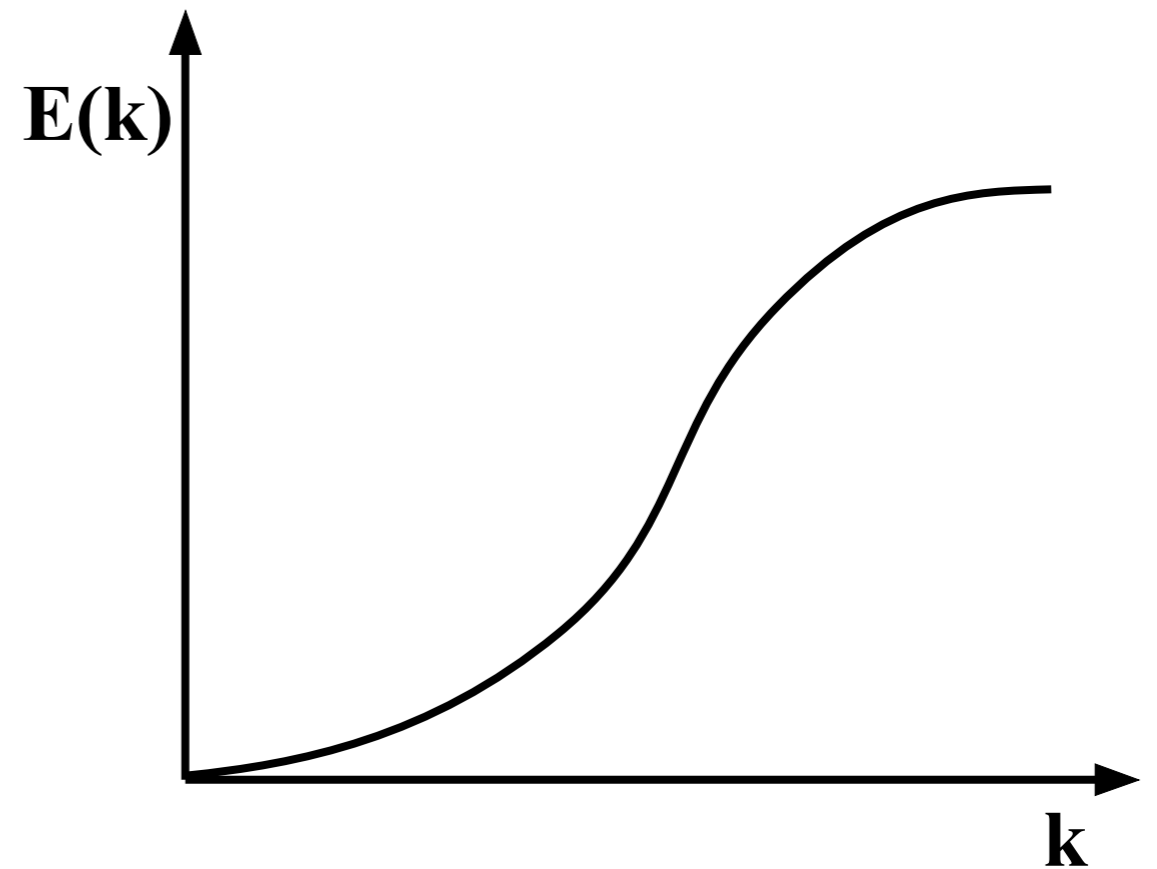
Beiträge zur Wärmekapazität



Elektronen vs. Phononen



$$f(E, t) = \frac{1}{e^{\frac{\hbar\omega}{kT}} - 1}$$



$$f(E, t) = \frac{1}{e^{\frac{E-E_F}{kT}} + 1}$$

Elektronische Wärmekapazität

Element	γ_{th}	γ_{exp}	Element	γ_{th}	γ_{exp}
	$\frac{10^{-4} \text{ J}}{\text{Mol K}^2}$	$\frac{10^{-4} \text{ J}}{\text{Mol K}^2}$		$\frac{10^{-4} \text{ J}}{\text{Mol K}^2}$	$\frac{10^{-4} \text{ J}}{\text{Mol K}^2}$
Li	7.5	17.5	Fe	6.3	50.1
Na	10.9	14.6	Mn	6.3	167.1
K	16.7	19.6	Zn	7.5	5.8
Rb	19.2	24.2	Cd	9.6	7.1
Cs	22.1	32.2	Hg	10.0	20.9
Cu	5.0	6.7	Al	9.2	12.5
Ag	6.3	6.7	Ga	10.0	6.3
Au	6.3	6.7	In	12.1	18.0
Be	5.0	2.1	Tl	13.0	14.6
Mg	10.0	13.4	Sn	13.8	18.4
Ca	15.0	27.2	Pb	15.0	29.2
Sr	18.0	36.3	Bi	18.0	0.8
Ba	19.6	27.2	Sb	16.3	6.3
Nb	6.7	83.6			

Schwere Fermionen

