ETH
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Solid State Theory
Exercise 13

FS 15
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Problem 13.1 Susceptibility from the atomic and conduction electrons

Consider a metal with a closed shell that has Z_c core electrons. The number of valent electrons is Z_v. Estimate the ratio of the Pauli and Landau susceptibilities to the susceptibility from the closed shell electrons.

Problem 13.2 De Haas - van Alphen effect

Calculate the free energy contribution

$$F = -T \sum_i \ln(1 + e^{(\mu - \varepsilon_i)/T})$$

using the Poisson summation formula

$$\sum_{n=-\infty}^{\infty} F(n) = \sum_{k=-\infty}^{\infty} \tilde{F}(k),$$

where $\tilde{F}(k) = \int_{-\infty}^{\infty} F(x) e^{-i2\pi kx} dx$ is the Fourier transform of $F(x)$. Find the oscillating term in the magnetization $M = -\partial F / \partial B$