Physics with neutrons 1

Michael Leitner, michael.leitner@frm2.tum.de
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Exercise sheet 11
To be discussed 2017-03-02, room C.3202

Franz Haslbeck, franz.haslbeck@frm2.tum.de

EXERCISE 11.1

Find the Fourier Transform of the Gaussian function

$$f(\omega) = e^{-\frac{1}{2}(\frac{\omega}{\sigma})^2}$$

and the Lorentzian function

$$g(\omega) = \frac{1}{\pi} \frac{\frac{1}{2}\Gamma}{(\omega - \omega_0)^2 + \left(\frac{1}{2}\Gamma\right)^2}.$$

EXERCISE 11.2

Most neutron experiments measure the scattering function $S(\mathbf{Q}, \omega)$. Neutron Spin-Echo (NSE) was introduced by Ferenc Mezei in the 1970s as a means of directly measuring $I(\mathbf{Q}, \tau)$, i.e. the Fourier-transform of the scattering function, the intermediate scattering function.
Derive the spin-echo condition for (quasi-)elastic scattering at a sample which links a change in the neutron energy to a change of the polarisation phase. Why is it possible to use a broad wavelength band $\delta\lambda/\lambda \sim 10^{-1}$ of incoming neutrons?

EXERCISE 11.3

Introduction of different Neutron-Spin-Echo techniques, their specifications, advantages and disadvantages.