# Physics with neutrons 2

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Exercise sheet 5
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### EXERCISE 5.1

a) Consider magnetic scattering on a single crystal of Ni (fcc). Calculate the contributions of the magnetic domains, which are aligned along the $<111>$ directions, to the $(111)$ Bragg peak.
What are the contributions to the $(111)$ peak for a completely isotropic distribution of the spins?

b) For the orthorhombic $UGe_2$ the magnetic moments are all aligned along the $[001]$ direction. Considering a powder sample: Which lines contain magnetic contributions and are most suitable for magnetic scattering?

### EXERCISE 5.2

Derive equation 1.

$$\overrightarrow{M_\perp^*} \cdot \overrightarrow{M_\perp} = \sum_{\alpha,\beta} \left( \delta_{\alpha\beta} - \hat{Q}_\alpha \hat{Q}_\beta \right) \cdot M_\alpha^* M_\beta \tag{1}$$

### EXERCISE 5.3

a) Calculate the form factor for an unpaired electron in a spherical shell of radius $R_0$.
b) What is the form factor for an unpaired electron inside a solid sphere of radius $R_0$?
c) Plot the form factors for 3d (e.g. Fe) and 4f electrons.
d) How much does the form factor diminish the magnetic scattering in the $(110)$ peak of Fe?