Physics with neutrons 2

Sebastian Mühlbauer, sebastian.muehlbauer@frm2.tum.de
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Exercise sheet 6
Due 2016–May–~~27~~ **30**

Lukas Karge, lukas.karge@frm2.tum.de, Tel.: 089-289-11774
Tobias Weber, tweber@frm2.tum.de

Due to the "bridging day" the next tutorial will be held on Monday, May 30, 8 am in the E21 seminar room.

Exercise 6.1

Consider the localized ferromagnet EuO and the itinerant ferromagnet Ni with their properties given in the table. Calculate the intensity ratio of magnetic scattering and nuclear scattering from the (111) Bragg peak in powder samples.

	EuO	Ni
crystal structure	fcc	fcc
lattice constants	$a_{EuO} = 5.13$ Å, $\alpha_{EuO} = 90°$	$a_{Ni} = 3.52$ Å, $\alpha_{Ni} = 90°$
nuclear scattering lengths	$b_{^{153}EuO} = 0.82 \cdot 10^{-12}$ cm,	$b_{Ni} = 1.03 \cdot 10^{-12}$ cm
	$b_O = 0.58 \cdot 10^{-12}$ cm	
magnetic moments	$7\mu_B$	$0.6\mu_B$

Exercise 6.2

a) Consider an fcc lattice with nearest and next-nearest neighbour interactions. Derive the ferromagnetic spin-wave dispersion relation.
b) Calculate the ferromagnetic spin-wave dispersion for a bcc lattice with nearest and next-nearest neighbour interactions.

Exercise 6.3

The ferromagnetic dispersion relation can be approximated by $E = Dq^2$ for small reduced momentum transfers q. D is the stiffness constant. Given the dispersion, calculate the specific heat.