UNIVERSITÄT SIEGEN
FESTKÖRPERPHYSIK

Solid state physics (*winter term 2015/2016*)

Lecturer: Prof. Dr. Ullrich. Pietsch Exercise tutor: Dr. Ali Abboud (ENC B-024)

Exercise sheet 11

Exercise 1: Magnon dispersion

Show that the dispersion relation for antiferromagnetic magnons is $\hbar\omega \propto |ka|$ instead of $\hbar\omega \propto |ka|^2$ in ferromagnetic case.

Hint: define a set of two differential equations for dS^x/dt and dS^y/dt for both sub lattices (similar to the approach for phonons of a two atomic chain).

Exercise 2: Time of flight measurement

In neutron scattering the scattering neutrons are often measured in time of flight mode, where the arrival time of the neutron at the detector after the scattering event is measured exploiting the white energy spectrum of a neutron source. Considering a neutron reflectivity experiment taken from a periodic super lattice with vertical spacing of d=2.5 nm one expects small angle Bragg peaks at $Q_n = \frac{n2\pi}{d}$

Which neutron energies are requested to record 1…5th order reflections? How these energy separates in terms of neutron velocity? What is the requested time

resolution of the experiment to separate these reflections? The distance between sample to detector is 10m.

Exercise 3: Bragg scattering of Antiferromagnetic

Considering a fcc biatomic compound AB of NaCl structure with a= 0.4 nm. Here the A atoms are carrying a spin which undergoes antiferromagnetic order below Neel temperature, T_N. The structure in paramagnetic and antiferromagnetic state is measured by a spin sensitive neutron elastic diffraction experiment. Shows the first 5 to 6 Bragg peak positions appearing for the experiment $T > T_N$. and $T < T_N$. considering the extinctions rules of fcc lattice.

Please return on 08/02/2016