
Neutron and X-ray Scattering of Quantum Materials

PHYS-640

Week 5 exercises

1: The small angle neutron scattering experiment

- (a) Exercise 7.P.2 in the neutron notes.
- (b) Exercise 7.P.4 in the neutron notes.

2: The neutron reflectometry experiment

A time-of-flight reflectometer with a wavelength range of $[0.5, 6.5]$ Å is used to study the surface of a dilute solution of molecules in deuterated water, D_2O . Calculate the critical wavevector transfer q_c of D_2O and suggest a suitable incident angle to use.

3: The beamtime proposal

Imagine that you have discovered a new mineral, magnificite. It is a strong ferromagnet and superconducting simultaneously. Now, you would like to characterize the magnetic structure in the compound as a function of temperature and magnetic field using neutron diffraction. Find a suitable instrument and write a beamtime proposal to perform the experiment. Some potentially helpful questions:

- Why is it important to do this experiment?
- In which form is the sample? (powder, crystal, liquid?)
- How did you characterize the sample already?
- Which temperature and field range do you need?
- Which scattering plane are you planning to use?
- How much time do you think is needed?