

22.106 Neutron Interactions and Applications (Spring 2005)

Problem Set No. 7

Due: May 3, 2005

The purpose of this Problem Set is primarily to go through the derivations of a number of key results encountered in the lectures on the theoretical basis underlying thermal neutron scattering and the dynamic structure factor $S(k, \omega)$.

Problem 1

Derive the Born approximation in neutron scattering, Eq. (15.26) in the Lecture Notes, starting with the integral equation approach to potential scattering.

Problem 2

Investigate the validity of the Born approximation for thermal neutron scattering to show whether or not the approximation is valid.

Problem 3

Give a detailed discussion of what is the Fermi pseudopotential. Why is it useful in thermal neutron scattering?

Problem 4

Show the double differential neutron scattering cross section can be expressed in terms of the dynamic structure factor, $S(k, \omega)$. Discuss briefly why this quantity is useful in the study of structure and dynamics of physical systems. Can $S(k, \omega)$ be calculated using Monte Carlo or Molecular Dynamics simulation?