

## Home work: Neutron Scattering

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1. What are the differences between spectroscopy and scattering? How are these methods used in solid-state physics and/or soft matter sciences?
2. What are the characteristic features of neutrons?
3. Discuss the differences between X-ray scattering and neutron scattering from the following viewpoints:  
wavelength, energy, scattering power, interactions with matter.
4. Calculate the scattering lengths of light water ( $\text{H}_2\text{O}$ ) and heavy water ( $\text{D}_2\text{O}$ ).
5. Discuss about elastic scattering, inelastic scattering, and incoherent scattering.
6. What does one should bear in mind when planning a neutron scattering experiment of soft matter?
7. Estimate the radius of gyration of a single polystyrene chain in unperturbed state with the molecular weight of  $10^4$ . Use the following values,  $7\text{\AA}$  and  $1\text{g/cm}^3$ , for the segment length and the mass density of polystyrene, respectively.
8. Describe briefly your proposal for neutron scattering, suppose you get a chance to work with neutron scattering.