# Scattering from Large-Scale Structures

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When radiation, such as light, neutrons, or x-rays impinges on a sample and is elastically scattered, the resultant angular distribution of the scattering intensity is directly related to the distribution of the scattering elements and thus the structure of the scattering object. The same physics come into play whether the radiation is light, x-rays or neutrons; and thus the same basic equations that correlate the angular dependence of the scattering intensity to the structure of the scattering object.

This course will explain the fundamental correlation between the angular dependence of the intensity of scattered radiation to the structure of the scattering object. In particular this relationship will be detailed for large scale structures such as micelles, polymers, and proteins. The study of these large structures requires that the scattering be measured at low momentum transfer vector or scattering vector (usually denoted as $q$ or $k$), which usually corresponds to measuring the scattering of the radiation at small angles. The equations and analytical methods that will be developed and explained will be applicable to the scattering of any radiation, but specific examples will concentrate on the use of neutron scattering to examine these large-scale structure.

Below is an outline of topics that will be covered in class:

1.) Intra-particle interference from large scale structures

Definition of **q**, momentum transfer

2.) Relationship between Scattering and Structure.

Density distribution function and Static correlation length

3.) Form Factors and Structure Factors

Scattering from two component systems

4.) Analysis of Scattering Data:

a. Behavior at Small **q**

b. The complete form factor

c. Intermediate and high **q** range

d. Fractal objects

e. Contrast Variation

f. Two-phase systems

5.) Real world Examples