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Using Neutrons for Material Research

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Neutrons are subatomic particles with no net electric charge, which means that they generally can penetrate deeper into matter than other subatomic particles. The interaction between neutrons and matter can be used to gather information about bulk characteristics of materials by evaluating the scattered neutrons. This opens a whole assortment of possible physics knowledge that can be acquired from studying neutron-matter interactions. This technique can be applied to a variety of materials but is particularly well suited for studying lighter elements such as hydrogen-rich materials. Neutron scattering is versatile and is used both for studying structures as well as dynamics on different lengths and time scales. The neutron scattering response can be inelastic, quasi-elastic, or elastic depending on the finite energy transfer between the neutrons and the material. The inelastic signal can probe the periodic motions of the molecules in the sample with a finite energy transfer, while the elastic signal is suitable for acquiring structural information. The Quasi-elastic neutron scattering is well suited to gather quantitative information about the correlation times and length scales of the diffuse motion occurring in hydrogenous materials in different geometries.

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