

# Inelastic Neutron Scattering

## A tool for studying lattice dynamics and magnetic excitations

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Inelastic scattering gives information about the dynamics in a system – in addition to „where the atoms are“ we can study „how they move“. Because of the interaction with magnetic spins, this includes the magnetic excitations, too. Neutron spectroscopy is therefore a key tool for deep understanding of material's properties, from ground state to functionality.

Based on the information given in the lectures before, the talk will basically introduce the (double-differential) cross sections, focusing on the difference between lattice and magnetic cases and the consequences for experimental use. The main experimental techniques – TAS, TOF and NSE – will be presented and their potential for different applications will be discussed, as well as ongoing developments in this field. Finally, examples from the current research will show the importance and the power of the method and give insight into a part of the exciting phenomena investigated in our days – e.g. hybridized phonon modes and phonon softening, phonons in shape memory alloys, excitations related to superconductivity, quantum criticality or frustration in magnetic systems.