NEUTRON TRIPLE-AXIS SPECTROSCOPY: FROM LARGE SINGLE CRYSTALS TO NANOSCALE SYSTEMS

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The traditional image of neutron inelastic scattering in single crystals is usually connected with studies of elementary excitations, aiming to parametrize the dispersion relations of phonons and magnons and to obtain quantitative information on the underlying hamiltonian of the system. While this field is continues to be very active, much of recent activities focus on investigations of the dynamics of nano-sized objects, ranging from solitons in quantum magnets via electron pairing in unconventional superconductors to nanodomains in ferroelectric relaxors and to adsorbed molecules in catalysts. Although neutron scattering, due to its inherent flux limitations, cannot investigate individual objects on this scale, it is highly efficient to establish energy spectra and correlation functions in space and time characterizing the global behavior of the ensembles of nano objects.

On the instrumentation side, advances in neutron optics and the use of arrays of analyzer/detector channels, providing simultaneous data acquisition over large ranges in the momentum-energy space have permitted to substantially reduce the needed sample masses into the < 1 g range and have paved the way to a more general use of neutron polarization analysis to discriminate between nuclear and magnetic excitations.