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Analysis Frameworks for Quasi-Elastic Neutron Scattering with Discrete Energy Transfers

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Quasi-elastic neutron scattering (QENS) allows to probe with a high energy resolution the total scattering function as a function of energy and momentum transfer $\hbar\omega$ and q, respectively. Classical QENS spectra are often captured with quasi-continuous energy transfers with acquisition times of several hours. Since the spectrometers are constantly upgraded, new measurement techniques are available. The possibility to move the monochromator in a neutron backscattering spectrometer with a constant velocity allows to probe the scattering function at a specified energy transfer. In principle, such measurements were possible also previously by changing the monochromator temperature, which however requires more time. These fixed window scans (FWS) result in high quality data with acquisition times of only a fraction of the one necessary for full QENS spectra. However, since only discrete energy transfers are available, the established approach, based on analyzing the energy dependence for each momentum transfer q individually, does fail. Here, we present new analysis frameworks for the FWS overcoming the mentioned limitations by combining different energy transfers. By including data from the new installed diffraction data, we have developed an approach determining the volume fraction of the solutes based on the data collected. The combination of this knowledge with established analysis frameworks allows to automatize the analysis frameworks and reduce the input parameters nedeed.

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