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Dynamics of proteins in aqueous solutions - recent advances using high-resolution neutron spectroscopy

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Novel high resolution neutron spectrometers permit new experiments probing several hierarchically superimposed levels of protein dynamics on the molecular level, and the nanosecond time scale internal motion of proteins in aqueous solutions at low concentrations of 50 to 200 mg/ml can be studied [1,2]. These novel experiments access the in-solution dynamics of proteins and its difference to the previously studied hydrated macromolecular powder dynamics. Simultaneously, the superimposed global center-of-mass motions can be accessed and decomposed in the rotational and translational diffusion contributions [3]. Neutron backscattering permits a unique access to the short-time self-diffusion of proteins and other macromolecules in aqueous solutions [4]. On this time scale, hydrodynamic interactions govern the diffusive motion. Current topics are being explored, amongst others, of macromolecular crowding [4], of "patchy"colloid physics [5,6], of protein cluster formation [2,5], of protein unfolding [7,8], and of intrinsically disordered proteins [9].

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