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Effect of the protein size on the diffusion of proteins in a cell-like environment - first results from BATS

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The investigation of protein diffusion is essential for a comprehensive understanding of living cells. Recently, the volume fraction dependence of the short-time center-of-mass self-diffusion of immunoglobulin (IgG) in naturally crowded environments has been reported. A remarkable agreement between simulations and experiment explained the agreement between the volume fraction dependence of pure IgG solutions and the naturally crowded samples [1]. The simulations revealed that this agreement is due to the comparable size of the IgG and the averaged size of the cellular lysate serving as crowding agent.

New neutron backscattering measurements with the BATS option of IN16B [2,3] allowed to investigate differently sized proteins in the presence of lysate. Given the increased energy range of BATS maintaining the good energy resolution, it is possible to separate the global diffusion from the internal diffusion. A dependence on the protein size of the diffusion in the presence of deuterated lysate functioning as a crowder has been observed. Global fits, taking the q and energy transfers into account, reveal different hierarchies of the internal diffusion. The comparison with the pure protein solutions at the same volume fractions allowed us to investigate the effects of lysate on the internal diffusion and thus, offer significant insights into the protein properties.

[1] M. Grimaldo et al, JPCL, 2019
[2] C. Beck et al, Physica B, 2019
[3] M. Appel et al, Sci. Rep., 2018

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