Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Dielectric response of hydrated proteins[1] DMITRY MATYUSHOV, Arizona State University — We study dipolar susceptibility of hydrated proteins, representing the average dipole moment induced at the hydrated protein by a uniform external field. This parameter shows remarkable variation among proteins. We find a negative value of the dipolar susceptibility for some proteins, which implies a dia-electric dipolar response and negative dielectrophoresis. Such proteins, even though carrying significant permanent dipole moments, repel from the electric field. This outcome is the result of a negative cross-correlation between the protein and water dipoles, compensating for the positive variance of the intrinsic protein dipole in the overall dipolar susceptibility. We therefore suggest that the dipolar response of proteins in solution is strongly affected by the coupling of the protein surface charge to the hydration water. The protein-water dipolar cross-correlations are long-ranged, extending approximately 2 nm from the protein surface into the bulk. A similar correlation length of about 1 nm is found for the electrostatic potential. The model is applied to the analysis of light absorption by protein solutions in the THz window of radiation. Here we also find significant deviations of the absorption coefficient from the predictions of traditional theories.

[1]supported by the NSF CHE-1213288

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Date submitted: 14 Dec 2012 Electronic form version 1.4