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Electric fields at biomolecular interfaces: ultrafast fluctuations in nanostructured environments

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Evaluating the electric interactions among charged and polar substructures distributed within the typically complex morphology of a biomolecular surface is challenging. It involves gauging the dielectric nature of the interfacial environment, where the bulk-like structure of the natural aqueous medium breaks down and leads to a distinct modification of its electric properties. A direct calibration by experimental methods is essential for gaining insight to this multi-body problem of electric interactions central for structure-function relationships in biological systems.

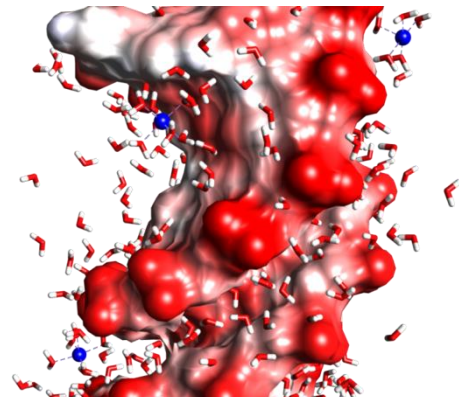


Fig. 1 Schematic surface potential of a DNA double-helix derived from X-ray structure PDB 1DPN.

This problem is approached for the case of the DNA double-helix by acquiring photon echoes from the mid-infrared resonances of molecular vibrations in the backbone that act as receivers of electric field fluctuations at the DNA-water interface [1-3]. The electric environment at the surface of the double-helix derived from tracing correlations within the two-dimensional lineshapes at sub-picosecond intervals is characterized by high-amplitude, thermally motivated field fluctuation from a compact region of the first two hydration layers and an effective screening of electric interactions with water dipoles and counterions beyond a sub-nanometer radius. The details and significance of this picture will be discussed for this prominent biomolecular system.

- [1] T. Siebert, B. Guchhait, Y. Liu, T. Elsaesser, *J. Phys. Chem. B* **119**, 9670 (2015).
 [2] B. Guchhait Y. Liu, T. Siebert, T. Elsaesser, *Struct. Dynamics* **3**, 043202 (2016).
 [3] T. Siebert, B. Guchhait, Y. Liu, B. Fingerhut, T. Elsaesser, *J. Phys. Chem. Lett.* **7**, 3131 (2016).

Für diese Zeit steht eine Kinderbetreuung nach vorheriger Anmeldung zur Verfügung.

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