The Quest for Charge Transport in single Adsorbed Long DNA-Based Molecules

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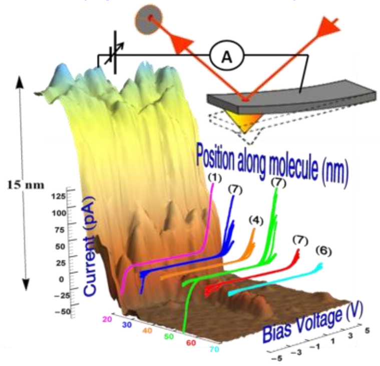

DNA and DNA-based polymers have been at the focus of molecular electronics owing to their programmable structural versatility. The variability in the measured molecules and experimental setups, caused largely by the contact problem, has produced a wide range of partial or seemingly contradictory results, highlighting the challenge to transport significant current through individual DNA-based molecules. A well-controlled experiment that would provide clear insight into the charge transport mechanism through a single long molecule deposited on a hard substrate has never been accomplished. In this lecture I will report on detailed and reproducible charge transport in G4-DNA, adsorbed on a mica substrate. Using a novel benchmark process for testing molecular conductance in single polymer wires, we observed currents of tens to over 100 pA in many G4-DNA molecules over distances ranging from tens to over 100 nm, compatible with a long-range thermal hopping between multi-tetrad segments. With this report, we answer a long-standing question about the ability of individual polymers to transport significant current over long distances when adsorbed a hard substrate, and its mechanism. These results may re-ignite the interest in DNA-based wires and devices towards a practical implementation of these wires in programmable circuits.

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