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Low-Energy Electron Interactions with Complex Targets.

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We have examined low-energy electron collisions with complex targets such as pristine nanoscale ice films and water/DNA interfaces by monitoring the reactive scattering processes leading to the formation of H (H^+), H_2 (H_2^+), O ^3P_J, O ^1D, OH^+, $H^+(H_2O)_n$ and DNA fragments. This work has shown that temperature-induced changes in the yields are due to subtle geometric and electronic structure changes brought about by changes in the interfacial hydrogen bonding structure. We have then exploited the fact that the two-hole localized states governing cation production and excitations involving a_1 levels are good probes of subtle structural changes in the water network. Since low-energy electrons can cause lethal damage to DNA, understanding the role of water and the DNA constituents in the damage event has recently received wide-spread attention. We have modified our multiple scattering "path approach" used to describe diffraction effects in stimulated desorption to calculate the diffraction and incident electron intensity at particular sections within a DNA double-strand. This approach assumes hypothetical electron scattering paths inside the target and calculates the interference of all elastically scattered components with the initial incoming wave. Constructive interference at zones localized within the DNA may locally enhance the dissociation probability.