Organization, Hydration, Ion Binding, and Inherent Electric Fields at Aqueous Surfaces

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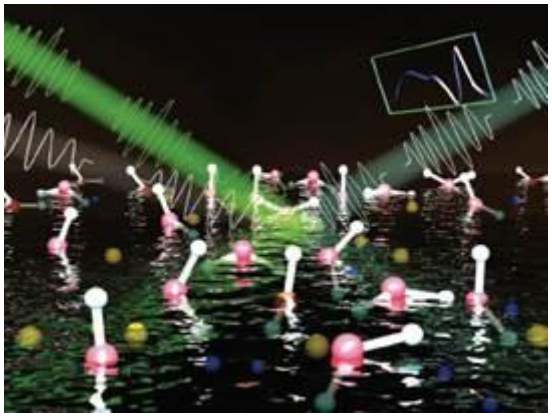

Surface properties and organization of water, ions, solutes and lipids are revealed using an array of nonlinear and linear spectroscopy (sum frequency and IR), surface tension, and imaging (Brewster angle) methods. Studies show significant differences with respect to inherent electric fields, and the reversal of such, dependent on ion identity and concentration. Motivated by atmospheric aerosol chemistry of marine and urban regions, and biophysical applications of lung surfactant, lipids and fatty acids are investigated to reveal their self-organizational properties at the surface of aqueous solutions. Binding of ions, simple and complex, to dipalmitoyl phosphatidyl choline (DPPC), dipalmitoyl phosphatidic acid (DPPA), and palmitic acid, are assessed through infrared reflection absorption spectroscopy (IRRAS) and sum frequency generation (SFG) with monolayer models. Intermolecular interaction and, in the case of arginine, binding geometries are elucidated. Glycine, guanidinium and pH are also investigated with DPPA.