

## Ion Distributions Near a Liquid-Liquid Interface

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Science **311**, 216-218 (2006)

Coulomb's Law describes the interaction between two, otherwise isolated, point charges. If many charges are present in the region between these two charges, the net interaction between them is modified. Real systems can consist of many charges, such as a plasma gas of electrons and ionized molecules, or electrolyte solutions containing many ions, or biological systems that contain highly charged biopolymers interacting with themselves and smaller ions. Debye suggested that an ion in solution is surrounded by other ions of opposite sign that act to screen its long-range Coulomb interaction. Earlier, Gouy and Chapman had described the diffuse ionic double layer that arises near a charged surface immersed in a solution with counterions. This double layer also screens long-range Coulomb interaction of the charged surface. These early theories ignored the liquid structure, such as the ion or solvent sizes and interactions between ion and solvent molecules that can lead to packing effects and spatial correlations. Although subsequent theoretical work treated these effects, experiments have not confirmed or denied these structural effects in a satisfactory manner.

Professor Mark Schlossman's research group has recently used x-ray reflectivity from ion distributions at the liquid-liquid interface to provide strong evidence that the interfacial liquid structure alters the ion distributions near a charged interface. These experiments were carried out at the Advanced Photon Source, ChemMatCARS 15-ID beamline (Argonne National Laboratory). The photo below shows Guangming Luo, the Post-Doctoral Fellow who played the leading role in these experiments, setting up the sample cell on a specialized liquid surface x-ray scattering instrument.

