



Wolfson Department of Chemical Engineering Seminar

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**Relaxation time spectra of the electrical double layer at the
glass/electrolyte interface**

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Ph.D. Seminar

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We introduce MHz-level frequency-modulated mechanical vibration in a glass substrate neighboring a dilute electrolyte solution to vibrate the ionic-structure of the electrical double layer (EDL) that appears spontaneously at the glass/electrolyte interface and study its relaxation toward equilibrium. We use theory to show that under vibration, the EDL leaks electrical fields that originate from the EDL zeta potential to the bulk of the electrolyte solution; the electrical field is enhanced where the vibration period synchronizes with ion-specific relaxation times of the EDL. We show measurements of EDL relaxation spectra that capture ion-specific and compound ion (salt) diffusion, i.e., the limit of the Nernst Hartley ion diffusion, through the EDL in an array of different electrolyte solutions. The spectra give the complex array of EDL relaxation modes of well-defined and isolated EDLs, and provide a tool for probing interfacial ion dynamics common in electrochemical, energy storage, and biological systems.