

QUANTUM ELECTRODYNAMICAL (QED) COHERENCE
AND
INTERFACIAL WATER

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It has been shown in the last 20 years in the conceptual framework of QED that liquids are two-fluid system. The first fluid is an ensemble of Coherence Domains (CD), where the component molecules oscillate in unison between two configurations of their electron cloud in tune with an e.m. field self-trapped in the CD. The second fluid is a dense gas of independent molecules, put out of tune by the thermal fluctuations, which is trapped in the interstices among CDs. The interplay between e.m. and thermal fluctuations produces a flickering mixture of the coherent and noncoherent fractions of the liquid. Water is peculiar since the coherent oscillation in the CDs raises the component molecules up to the threshold of ionization, so that in each CD there is a plasma of quasi-free electrons, whose excitations give rise to a spectrum. It is thus possible to induce CD oscillations able to produce a coherence among CDs, that can reach macroscopic sizes. A surface is able to interact with water CDs producing a further stabilization that shields water CDs at the interface from thermal fluctuations. Interfacial water is thus almost fully coherent and exhibits the corresponding properties:

- i) the exclusion of the noncoherent fraction prevents solutes from entering interfacial water (exclusion zone)
- ii) the presence of a plasma of quasi-free electrons in the CDs makes interfacial water a donor of electrons, so that it becomes a reducing agent.

CDs, as all coherent systems, are able to add to their chemical potential any externally applied e.m. potential (Bohm-Aharonov effect). Then a negatively charged surface lowers the CD chemical potential, producing the crowding of many CDs and the formation of an exclusion zone, whereas the opposite result is produced by a positively charged surface. The emerging QED picture of the interfacial water supports the findings of the Pollack group. An independent electrochemical evidence is presented, that supports such findings.