The role of ions in the first nanometer below the water-air interface detected by nanometric capillary waves as observed by the LIFI interferometer.

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The LIFI (Liquid Interface Force Interferometer) technique[1] detects surface waves at the air–water interface with amplitudes ranging from ångströms to tenths of a nanometer. We investigate the resonant response of millimeter-sized bubbles to elucidate the role of the ionic strength of the surrounding solution. A range of salts with concentrations between 0.1 and 3 mM is examined. Variations in salt concentration mainly affect the amplitude of capillary surface waves, while only weakly influencing the quality factor of the resonance peaks. Salts with different ionic mobilities, including NaCl, KCl, and larger heavy ions, are compared, together with NaOH and HCl to probe their specific effect and the change of interfacial pH. Increasing the pH appears to slightly stiffen the interface and broaden the resonance, differently then other salts . The frequency dependence of the cross-phase between the exciting field and the resonant response[2] in the vicinity of the resonance peak provides the sign of the effective charge and the feature of the response. Concurrent conductivity measurements ensure accurate control of relevant solution parameters.

References:

[1] M. Corti, M. Bonomo, and A. Raudino. Langmuir 28 6060 (2012)
[2] D. Raciti, P. Brocca, A. Raudino and M. Corti. J. Fluid Mech. Accepted (2022)