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Optical second harmonic generation at liquid interface

Nonlinear optics are powerful tools for structural investigation of liquids. In particular, surface second harmonic generation (SSHG) has been demonstrated to be able to probe the properties of liquids at molecular scale. In fact, second harmonic generation (SHG) signal generated at the liquid interface (e.g. air/water interface) contains information on the elements of the second order nonlinear optical susceptibility tensor (χ_2), which is linked to the molecular orientation within the liquid bulk. To go further, we try to demonstrate a new approach for the study of surface charged liquids. The method is based on a phase sensitive second harmonic generation (PS-SHG) that allows us to measure the phase of the collected SSHG signal. In doing so, we have access to the phase of the effective second order non-linear optical susceptibility tensor (χ_2^{eff}) and, thus, the orientation and organization of surfactant at the liquid interface. In conclusion the, knowledge of the module of χ_2 gives us the surfactant mean orientation, whereas the phase of χ_2^{eff} allows us to have access to the value of the electrical static field created by the Debay layer, the absolute surface charge density and surface potential.

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