

# The Water Surface: Complex, Dynamic and Wet

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Water surfaces and interfaces are ubiquitous, not just in nature (e.g. at the boundaries of cells, in rain drops, oceans, rivers and lakes) but also in many technological applications (such as electrochemistry and photocatalytic water splitting). Water is a rather unique liquid, owing to its strong intermolecular interactions: strong hydrogen bonds hold water molecules together. At the surface of water, the water hydrogen-bonded network is abruptly interrupted, conferring properties on interfacial water different from bulk water [1].

We elucidate the structure and structural dynamics of interfacial water using surface-specific vibrational spectroscopy of interfacial water molecules, with femtosecond time resolution. Specifically, we find that the interface is structurally more heterogeneous [2,3] and substantially more dynamical [4] than bulk water. We reveal the nature of the heterogeneity, and quantify the reorientational dynamics of specifically interfacial water molecules. Finally, we show that the evaporation of water – i.e. the release of individual water molecules from the bulk into the gas phase – is not a purely stochastic event. Rather, the evaporation follows one specific pathway, involving a delicately timed, concerted motion of several water molecules to ‘launch’ a single molecule from the surface [5].

## References

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