2.091 Caught in the act: interfacial acid base chemistry.

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Abstract:

Research over the past decades has provided an impressive observational basis of large scale effects that heterogeneous chemistry on ice has on Earth's atmosphere, such as substantial modification of the composition and of the chemical reactivity of the lowermost atmosphere in Polar regions. Here, we present fundamental details on the chemical mechanisms operating at the interfacial region of environmental snow and ice derived from laboratory based experiments.
The research is taking full advantage of X-ray excited electron spectroscopy to directly probe the chemical speciation of adsorbates and the hydrogen-bond structure at the air-ice interface in the temperature range of 230 - 255 K and at low surface coverage. The results confirm that surfaces are chemically unique from the underlying bulk and we interpret the data as

- a Janus-type character of physisorbed acids: Undissociated at the outermost ice surface and dissociation occurring upon solvation deeper in the interfacial region. This indicates that the classical concept of acid-base equilibria might not hold at interfaces.
- a non-uniform hydrogen bonding network along the depth of the interfacial region.

Even with a focus of this presentation on adsorption of acidic trace gases (HCl, HNO3, formic acid, acetic acid) at the air-ice interface, the details on interfacial chemistry might be of high relevance to atmospheric and environmental science in general as it tackles two essential concepts in chemistry: acidity and hydrogen-bonds.

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