

A habitat for life

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The aim for the presentation is to open a discussion on how our community (working on Lifshitz and double layer interactions) could contribute further to the fundamental understanding in various environmental applications related to ice and water, as well as to the flux of greenhouse gas molecules across water surfaces. Some of the main ideas can be traced back to a paper published in Physical Review Letters by Elbaum and Schick [1] on premelting of ice which can be related to a water film thickness dependent transition from repulsive to attractive force associated with Lifshitz free energy for the three layer system of ice-water-vapor. Interesting applications of ice premelting have been suggested in papers by Dash and collaborators, e.g. frost heaving [2] and charging of thunder clouds [3] (for a review see Ref. [4]). The specific problems I will discuss are the following:

1. It is known that large ice structures in water float with a fraction of its volume above a water surface. Can tiny ice particles sink below a water surface due to buoyancy, double layer forces and Lifshitz forces [5]?
2. Can ice form at the interface between ice cold water and quartz [6]?
3. Some focus will be on the effect of Lifshitz and ionic forces on premelting layer at ice surfaces [7], as well as to the question if complete melting can occur inside a pore [8].
4. Can the above topics somehow be related to different habitats for life which we associate with presence of liquid water [4]?
5. At the end I will discuss how there is a need for more accurate measurements of dielectric functions of water and ice at different temperatures and over a large frequency range. The lack of accurate enough dielectric functions and missing proper theory for charge effects inhibit understanding of both gas fluxes [9] across water surface and ice premelting.

References

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