Ice and Victoria Buch: a cold surface and a warm heart

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Victoria Buch, who knew so much about ice and hydrogen bonds, was intrigued and fascinated by the possible physical states of the ice surface. She knew on one hand that it was only reasonable to expect the proton disorder of bulk ice to persist at the surface. She also on the other hand felt, or hoped, that the surface energetics should favor some new type of surface proton order, absent in bulk ice.

To pursue this fragile dream, she stole time away from her heartier physico-chemical studies, and from her warm-hearted generous political battles within Israel, to collaborate with a surface theorist, whom she met by chance one summer in Lugano -- me. Me, who would contribute nothing more than some generic wisdom, and no actual hard calculations.

Her own calculations, both Molecular Dynamics and Monte Carlo, eventually showed that in the cold ice surface not only the oxygen atoms would stay put and crystalline up until some 180 K, but showed that at low enough temperatures the protons too would order -- and that in spite of proton disorder in the underlying bulk! My own job ended up being to recognize that this surface order, 2x1 stripes formed by rows of "dangling hydrogens" and "dangling oxygens" (an old suggestion by Fletcher) could finally make sense of some unexplained helium scattering data obtained a decade earlier in Goettingen.

Victoria and I were still collaborating, and spending hours on the phone at that, when her fatal disease came. She very much wanted to find out how fragile or robust the ordered surface striped phase would be against temperature. My Landay theory said there should be a first order transition between 2x1 stripes and thermal disorder, at some unknown temperature. Her preliminary model Monte Carlo study found precisely such a transition around 60 K. While we must now wait for some data or for newer, less tentative calculations to follow those by Victoria, 60 K remains my best estimate for the "Buch transition" temperature at the surface of hexagonal ice.