# Heterogeneous Electro-Freezing of Super-Cooled Water on Surfaces of Polar Crystals

**Meir Lahav, David Ehre, Sofia Curland, Elena Meirzadeh and Igor Lubomirsky**

**Weizmann Institute of Science.**

Ice melts at 0˚C, however water can be super-cooled (SCW) in a clean environment down to ~-40˚C without freezing. Control of the temperature of freezing of SCW is of significant importance for instance in biology, in the climate sciences, in technology to mention but a few. This temperature is generally controlled heterogeneously with the assistance of auxiliary materials. In our studies we discovered that surfaces of polar crystals and ceramics surfaces induce ice nucleation at temperatures, which are higher by ~5-8˚C in comparison to freezing temperatures measured on surfaces of analogous non-polar surfaces of similar packing arrangements.[1,2.] Polar materials are pyro-electric, which develop temporary surface charge in response to temperature variations. With these materials in hand, we are able to demonstrate that positive charges elevate, whereas negative charges reduce, the freezing temperature of SCW.[2] We shall provide experimental evidence suggesting that the electro-freezing is a chemical process induced by protons and OH-ions. [3,4]

1. Gavish, M.; Wang, J.-L.; Eisenstein, M.; Lahav, M.; Leiserowitz, L.. *Science* **1992**, *256*, 815.
2. Ehre, D.; Lavert, E.; Lahav, M.; Lubomirsky, I., *Science* **2010**, *327*, 672.
3. Belitzky. A, Mishuk, E. Ehre.D, Lahav, M and Lubomirsky. I J.Phys. Lett. **2016,** *15,* 2445.
4. S.Curland, D.Ehre work in progress