Ice on a metal: How does the structure change with temperature and what else can we doe to manipulate the ice?

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High resolution low-temperature scanning tunneling microscopy offers an unprecedented view into the formation and dynamics of ice, which we have investigated on the (111) faces of Cu, Ag, and Au between 17 K and 150 K.

We first investigate particularly stable nanoclusters consisting of six to nine molecules.

Then, we study the thermally activated transition from amorphous to crystalline ice (D_2O) on Cu(111). Annealing of amorphous solid water up to the desorption temperature of 149 K results subsequently in monomer decorated double bilayers with different superstructure, a faceted surface, pyramidal islands, and nanocrystallites of distinct height at different coverages. These structures will be discussed in detail. It is found that though all structures are truncations from crystalline water ice, for none of them the ice bilayer is found to be the terminating surface.

The dynamics of solvated electrons within the crystalline ice structures is investigated by two-photon photoemission. Inelastic electron tunneling manipulation allows dissociating the ice within these clusters as proven by inelastic electron tunneling spectroscopy.