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From glacier beds to the stratosphere: geophysical effects of the basic phase behavior of ice

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Modern research methods have shed light on old problems in melting, teasing out the role of intermolecular interactions and their influence in a host of geophysical phenomena. Faraday performed experiments that probed the heart of the matter and now we have accumulated a wide body of refined experimental evidence which shows that ice melts below the melting point, that is, it *premelts*. The phenomenon of *premelting* occurs at the interface between ice and the vapor, a substrate and between two or more crystals. Premelting controls the sintering, coarsening, mechanical and transport behavior of single and polycrystalline ice. It is known to influence, among many other things, properties at the base of glaciers, in snowpacks, permafrost, sea ice, thunderstorm lightning and heterogeneous stratospheric chemistry. In this talk we discuss the basic physics and then explore a number of geophysical consequences.