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Development of instruments for the investigation of extraterrestrial ice layers

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For the investigation of terrestrial ice layers different kinds of penetration devices exist. Examples are drills, hammering devices (moles) and melting probes. With the development of planetary lander missions the availability of suitable instruments for subsurface investigations of planetary ice layers becomes increasingly important. In particular the polar layers of the Mars polar caps and the surface of the Jovian satellite Europa have been proposed in the recent past as interesting targets for subsurface ice investigations. The permanent ice caps on Mars may contain key information for the understanding of the recent geological history and the water exchange between the atmosphere and the surface. Europa is particularly interesting for exobiologists, since primitive forms of life may exist in the supposed subsurface ocean, which might also be frozen into the near-surface ice.

Recently at the Space Research Institute in Graz a new study was initiated in the frame of an ESA contract to develop a "melting probe" suitable for the use on bodies with low surface pressure. In this contribution we introduce the thermal and mechanical design of a first prototype and report on the results of ice penetration tests under cryo-vacuum conditions as well as the first results of thermal modelling.