



Thermal conductivity measurements of frozen salt solutions in Jovian moons to support future JUICE mission.

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The upcoming JUpiter ICy moons Explorer (JUICE) (ESA) and Europa Clipper (NASA) missions will perform detailed observations of the giant gaseous planet Jupiter and three of its largest moons (Ganymede, Callisto, and Europa).

A series of experiments was performed to measure the thermal conductivity and calorimetry of macroscopic frozen salt solutions of particular interest in Jovian icy moons. The following salts were investigated: Na-chloride (NaCl), Mg-sulphate (MgSO₄), sodium sulphate (Na₂SO₄), and Magnesium chloride (MgCl₂). Measurements were performed at atmospheric pressure and temperatures from 0 to -70°C in a climatic chamber. Temperature and thermal conductivity were measured during the course of the experiments. A small sample of the liquid salt-water solution was set aside for the calorimetry measurements. A side effect of the measurements is that they served to spot phase changes in the ice mixtures with high sensitivity. An important result is that, the phase changes observed in the standard calorimetric tests, could be monitored in situ with high sensitivity in the thermal conductivity measurements. Indeed, when a phase change occurs, a large peak appeared in the thermal conductivity values as the result of the natural heat release that accompanied the phase change.