Elastic properties of high pressures ices and their implication for the evolution of icy satellites

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Space missions to the outer Solar system have revealed a diverse world of icy planets and satellites. This diversity attests to the different internal processes active since accretion which have led to varying degrees of differentiation of the interior of the icy bodies [1]. A key parameter controlling early differentiation is the rate of heat dissipation from the interior through convection. These early dynamic processes depend on the thermodynamic and mechanical properties of icy materials at the temperature, pressure and composition conditions encompassed by the icy satellites. Models of the internal structure of large and only partially differentiated bodies like Callisto are poorly constrained due to the lack of accurate elastic parameters for the high pressure forms of ices VI and VII at temperatures between 200 and 350 K. Moreover, given the relatively softer structure of ice, non-hydrostatic stresses may extremely influence the elastic and non-elastic responses of these materials. The aim of this study is to determine simultaneously density and elastic constants of single crystals of ice VI at high pressures by means of high-pressure single-crystal X-ray diffraction (SCXRD) and Brillouin spectroscopy and to carefully analyze the effect of non-hydrostatic stresses on the compressibility of this material.

Single crystals of ice VI have been grown *in situ* inside diamond anvil cells. The unit-cell lattice parameters of ice VI collected up to 2.1 GPa are in a good agreement with previously reported compressibility data [2], however major broadening due to microscopic strains inside the ice crystal has been observed. Such behaviour suggests that the uniaxial stress is not uniformly distributed along the load axis. Brillouin data are measured at the moment to obtain insight into the effect of these stresses on the elastic behavior of ice VI.

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