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An atomistic view of the protolunar disk

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We study the formation and the evolution of the protolunar disk as a result of the giant Impact for Earth-like planets. We consider Bulk Silicate Earth compositions, and we allow for the presence of a series of volatiles. We cover thermodynamic conditions of the entire disk. We perform first-principles molecular dynamics simulations to understand the physical and chemical behaviour of the molten protolunar disk, at the atomic level.
Based on our simulations we characterise the properties of the protolunar disk, but also the initial state of the Earth condensation, and we propose an alternative scenario for the chemical mixing in the disk. We obtain that the largest part of the disk was in the supercritical state for a long time. We discuss the effect of a selected collection of volatiles on the structure and properties of the disk. When volatiles are present in the system, such molecular species are the first ones to evaporate and be present in gas bubbles. We interpret the bubble nucleation in terms of the liquid-vapor equilibrium. At high temperature, we identify the supercritical region characterised by one homogeneous fluid, featuring peculiar chemical speciation and short lifetimes.

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