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**A Smoothed Particle Hydrodynamics
Method for Modelling the Dynamics of
Magma Ocean Solidification**

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The solidification of a magma ocean is a very complex process where emerging crystals can grow or remelt, settle or be kept in suspension.

We have developed a new solidification model based on the Smoothed Particle Hydrodynamics (SPH) method, which is very suitable for multi-phase systems. Both melt and crystals are represented by SPH particles. Depending on the material properties and boundary conditions, scenarios with fractional and/or equilibrium crystallisation can be analysed. Our model supports different geometries, from a 2D Cartesian box to a 3D spherical shell, and allows for regional magma oceans as well. Because tracers are „built-in“ with the SPH method, we can track the distribution of volatiles without additional overhead. We can model additional impacts during the solidification and the distribution of the impactors' material. Our code is parallelised and optimised to run on GPUs.

We are confident the new model will prove to be a valuable tool to better understand key features of transport phenomena in the magma ocean and their importance.

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