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Early Differentiation Of Terrestrial Planets: First Approach With Transient Simulations

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The formation of a planetary core in terrestrial planets is still not well understood. Nevertheless there are some preferred models for the differentiation of the iron and silicate phase. One of them is the sinking of kilometer–sized iron bodies (dipairs) though the solid and relatively cold mantle of a proto–planet. These diapirs could originate from the iron layer at the bottom of a magma ocean by a Rayleigh–Taylor instability. We did a first approach to the numerical simulation of planetary core formation by modelling the sinking of kilometer sized iron diapirs through the silicate mantle by simulating the flow of silicate material around a single iron sphere. In the first instance we used a stationary simulation with a single obstacle on a fixed mesh. Although the model was simple and we made some rough assumptions, we could already explain some major features of core formation by sinking hot iron diapirs. The results are consistent with cosmochemical constraints for instance. Nevertheless there are many possibilities to improve the model. The first step is achieved by using a transient version of the underlying software package (FEATFLOW). It is now possible to simulate several objects falling simultaneously, study their behaviour and and observe how they influence each other. Here we discuss the method and present some early results that were obtained with the extended numerical simulation package.