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Early Lunar convection with pressure-dependent rheology CALLUM WATSON, JEROME NEUFELD, DAMTP, University of Cambridge, UK, CHLO MICHAUT, LGLTPE, cole Normale Suprieure de Lyon, France — The Moon's crust is known to have formed over 4 Ga ago during the convective cooling of an early global magma ocean. Due to the strongly temperature dependent viscosity of magma, a thick boundary layer known as a *stagnant lid* is thought to have formed, the cooling of which resulted in the Lunar crust. Observations of the Lunar gravitational field and topography show that there is a significant hemispheric crustal dichotomy: the far side is far thicker than that the near side.

We consider a simple one-dimensional model with pressure- and temperature- dependent silicate viscosity, with a stagnant lid divided into two hemispheres overlying a well-mixed silicate interior and ferrous core. We find that when the viscosity increases sufficiently rapidly with pressure, an symmetric state is unstable to anti-symmetric perturbations in stagnant-lid thickness. This instability saturates only when a significant dichotomy has developed in the stagnant lid.

The crustal thickness is reflective of the asymmetric stagnant lid thickness, by having a crust that forms from compaction of the stagnant lid. Our model suggests a mechanism for the observed crustal dichotomy, and additionally resolves issues with the timescale of formation.

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