Abstract Submitted
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Shock physics of giant impacts: Transforming rocky planets into supercritical synestias[1] SARAH STEWART, ERIK DAVIES, MEGAN DUNCAN, U. California Davis, SIMON LOCK, Caltech, SETH ROOT, JOSHUA TOWNSEND, Sandia National Labs, RAZVAN CARACAS, CNRS, RICHARD KRAUS, Lawrence Livermore National Lab, STEIN JACOBSEN, Harvard — Rocky planets form by a series of giant impacts with sufficient energy to vaporize the outer layers of the bodies. In many giant impacts, the colliding planets are transformed into a new type of astronomical object called a synestia, which is a body that exceeds the limit of a spheroidal shape. In most events that produce an Earth-mass body, the collision creates a supercritical synestia with an internal temperature-pressure profile that exceeds the critical point for silicates. Here, we present the results from numerical simulations of giant impacts using a forsterite equation of state for the silicate mantle. We compare our results to recently obtained critical points for silicates derived from experiments at the Sandia Z Machine and ab initial calculations. Transformation of planets into supercritical synestias affects the chemical and thermal evolution of the body. Cooling and differentiation of synestias follows a different thermodynamic path than previous models of magma oceans. We emphasize the critical need for studies of multicomponent chemical systems to understand the outcomes of giant impacts during planet formation.

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Sarah Stewart - Mukhopadhyay
University of California, Davis

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