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Physics of impact events across terrestrial and planetary surfaces

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Impact cratering is a physical process causing geological changes on all planetary surfaces. It is one of common processes responsible for crustal structure and evolution over geological timescales. High-fidelity shock physics simulations are made to track the fate of a planetary impactor and associated shock changes in the target material during a non-catastrophic impact event. The size of the impactor ranged from 10 to 250 km in diameter, moving at 15 to 60 km/s impact speed across a range of parent-body gravities. Impactors were considered spherical (chondritic-only, iron-only, and differentiated into iron core and rocky mantle). This work investigates delivery of extraterrestrial material to planetary surfaces, including but not limited to magnetic signatures associated with large impact craters that may result from impact-delivered localized iron enrichments. Shock physics calculations were applied to understand what portion of impactors melted and vapourized as well as where the remaining solid and melt inclusions were embedded in the planetary crust. Division of impact energy to kinetic energy of excavation and internal heating was mapped as a function of impactor and crust properties, with emphasis on porosity and composition effects in order to better understand the shock physics process planetary surfaces endure.

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