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Why nano-projectiles work differently than macro-impactors-role of plastic flow[1] E.M. BRINGA, CONICET and Instituto de Ciencias Basicas, Universidad Nacional de Cuyo, Mendoza, 5500 Argentina, CHRISTIAN ANDERS, GEROLF ZIEGENHAIN, Fachbereich Physik und Forschungszentrum OPTIMAS, Universitat Kaiserslautern, Germany, GILES GRAHAM, Mineralogy Department, The Natural History Museum, London SW7 5BD, United Kingdom, J. FREDDY HANSEN, Lawrence Livermore National Laboratory, Livermore CA 94550, USA, NIGEL PARK, AWE, Plc Aldermaston, Reading, UK, NICK TESLICH, Lawrence Livermore National Laboratory, Livermore CA 94550, USA, HERBERT URBASSEK, Fachbereich Physik und Forschungszentrum OPTIMAS, Universitat Kaiserslautern, Germany — Hypervelocity impacts provide a way to take localized regions of a target to extreme pressure and temperature conditions. Resulting crater features can be challenging for hydrocode simulations and test the validity of constitutive models. We will present atomistic simulation data on crater formation due to hypervelocity impact of nanoprojectiles of up to 55 nm diameter and with targets containing up to ten billion atoms, and compare them to available experimental data on micron-, mm-, and cm-sized projectiles. We show that previous scaling laws do not hold in the nano-regime and outline the reasons: within our simulations we observe that the cratering mechanism changes, going from the smallest to the largest simulated scales, from an evaporative regime to a regime where melt and plastic flow dominate, as it is expected in larger micro-scale experiments. The importance of strain-rate dependence of strength and of dislocation production and motion under these extreme conditions will be discussed.

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