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Momentum Enhancement due to Crater Ejecta during Hypervelocity Impact of Highly Porous and Consolidated Rock JAMES WALKER, SIDNEY CHOCRON, DONALD GROSCH, DANIEL DURDA, Southwest Research Institute, KEVIN HOUSEN, Boeing (Ret) — Experiments were performed with impacts of 2.54- to 4.45-cm-diameter aluminum spheres at 2.1 km/s into both consolidated rock (granite) and highly porous rock (pumice). Measured in these experiments was the momentum enhancement that is, how much momentum is transferred to the rock by the impactor. The transferred momentum is greater than the impactor due to the crater ejecta. The momentum enhancement is characterized by β, which is the ratio of the momentum transferred to the target and the momentum of the impactor. High speed video recorded the impact event, the ejecta from the target, and the motion of the target (hung in a ballistic pendulum arrangement). Constitutive models of rock that include porosity and crush-up behavior when incorporated into impact physics codes (specifically CTH and EPIC) show good agreement with crater depth, but they do not show good agreement with momentum enhancement. This paper will review the data and place it in the context of other momentum enhancement data, including the nonlinear effect of scale size. It will also explore the difficulties in large-scale numerical modeling of the momentum enhancement. An application of this data is determining the effectiveness of deflecting asteroids and comet nuclei by hypervelocity impacts.

Thomas Moore
Southwest Research Institute

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