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Impact cratering in fluidized granular matter PATRICK MAYOR, HIROAKI KATSURAGI, DOUGLAS J. DURIAN, Department of Physics and Astronomy, University of Pennsylvania, Philadelphia, PA 19104 — Impacts by projectiles dropped into granular media are an important example of how particulate materials respond to externally applied forces. Beyond the obvious geophysical case of planetary craters, understanding the details of impact mechanisms can provide valuable information on these systems, and the phenomenon has been actively investigated. In particular, recent experiments have studied the penetration depth of projectiles impacting granular materials at relatively low speeds, and measured the dynamics of the impact process, yielding force laws accounting for the observations. We have studied how the impact phenomenon is affected when the granular medium is submitted to a vertical upward (or downward) gas flow, in a range of flow rates below the bubbling regime. These fluidized granular systems yield, logically, deeper impacts, and dynamics measurements reveal that the stopping time is also longer, contrary to what is observed when deeper craters are obtained by increasing the impact velocity. We observe that the parameters involved in previously obtained force laws are modified in a simple way as a function of the flow rate and find a velocity-dependent inertial term and a depth-dependent friction force that vanishes as the flow rate approaches the fluidization threshold.

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