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Impact experiments for the interpretation of SMART-1 impact on the Moon

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On September 3^{rd}, 2006 the ESA SMART-1 spacecraft ended its mission impacting on the Moon. The impact geometry was such that the spacecraft touch down with a very grazing incidence (no higher than few degrees) and the impact event was observed from ground.

Some ground-based telescopes were able to observe the flash of light produced during the impact, but it was not possible to observe the crater, even if, from calculations, it was expected to be 3-10 meters wide and 1 meter deep.

We report on an impact hypervelocity experiments aimed at simulating SMART-1 grazing impact on the lunar surface and for the characterization of the flash generated by the impact. Tests and numerical simulations have been performed at CISAS, University of Padova, using the two-stage light gas gun and hydrocodes in order to support the interpretation of the physics of the event and the observational data, thus better constraining the current understanding of impact processes.

Oblique impact tests at different grazing angle on sand as lunar soil simulant, resulted in multiple elongated craters with rebound of the projectile: ricochet. The experimental data have also been reproduced numerically by hydrocodes (using Autodyn 3D software) and the results compared.

The results seems to suggest that the impact may have caused a shallow elongated crater at the touch-down, and produced a high speed rebouncing of the spacecraft.