A review of computer simulation experiments of Lunar Hole formation

（月の縦孔形成の計算機実験レビュー）

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ABSTRACT

Japan's lunar explorer SELENE discovered three large vertical holes of several 10 m to 100 m diameter and depth on the Moon. The formation mechanism of the lunar holes is a big issue and very interesting from the view point of science and the future utilization of the lunar cavities. A possible formation trigger of the holes is meteorite impact. To discuss the impact-induced hole formation, previously performed laboratory and computer impact simulation are instructive, but not enough. It is uncertain that the results from laboratory scale impact experiments can be applied to the planetary scale impacts. Any computer simulation for meteorite impacts onto a surface with underlying cavity has not been performed.

In this study, we performed computer experiments to simulate meteorite impact onto a thick (finite) roof of a cavity on the Moon, using Impact Simplified Arbitrary Lagrangian Eulerian (iSALE) cord. We found that impact damage occurred not only at the lunar surface (the top side of the roof) but also at the ceiling of the cavity (the bottom side of the roof of the cavity); this is a back-spallation phenomena. Sands piled up evenly on the floors of the lunar holes could be explained as completely damaged materials of a significant volume of the ceiling of the cavity by the back-spallation phenomena.