Relationship between ejecta pattern and target particle size distribution

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In recent years, impact experiments have been conducted on asteroid exploration such as Hayabusa2 and DART, and patterns extending across the entire ejecta curtain have been observed. The images of the asteroid surface show the presence of boulders with various sizes, and is expected to affect the patterns in ejecta curtain.
It has been shown that when the granular target consists of particles with the same size, the impacts produce a mesh-like pattern in the inverted cone-shaped ejecta curtain. In contrast, when the target particles have a size distribution, a large-scale pattern that extends across the entire ejecta curtain is produced.
In this study, we analyze ejecta curtain patterns for various size distributions, including the observational results obtained during asteroid exploration (i.e., Hayabusa2 and DART). The patterns were binarized and the characteristic size of the patterns was defined. Furthermore, a parameter representing the degree of mass concentration in the size distribution of the target particles was defined, and its relationship with the characteristic size of the patterns was investigated. It is thought that the relative velocity between particles, which depends on the degree of mass concentration, produces the patterns.

Keywords: Impact, ejecta pattern, Size distribution of target particles

