Luminous Flashes Generated in Highvelocity Laboratory Impact Experiments

M. YANAGISAWA[1], Y. ISHIGURE[1], S. TANAKA[1], H. AOKI[1], and S. HASEGAWA[2]

[1] *University of Electro-Communications, Tokyo 182-8585, Japan*

[2] *Institute of Space and Astronautical Science/JAXA, Kanagawa 229-8510, Japan*

Impact cratering is one of the fundamental geological processes to the planets and moons. Collisional disruptions have played important roles in the evolution of the small solar system bodies. Many laboratory experiments have therefore been made to simulate the highvelocity impacts in the solar system. We report here on a result of our experiments simulating meteoroid impacts on the lunar surface.

Meteoroid impacts on the lunar surface have recently been observed as lunar impact flashes by ground based small telescopes equipped with video cameras [1]. The most important parameter of the impact phenomena is the impact energy, that is, the kinetic energy of a meteoroid. Ratio of the luminous energy derived from the astronomical observation to the impact energy, defined as luminous efficiency, is required to know the important parameter. However, the efficiency is not well known, and has been roughly estimated to be ~ 10^{-3} only for the 1999 Leonid lunar impact flashes by comparing the brightness-number distributions of the lunar flashes with the terrestrial meteors [2]. The efficiency would depend on impact velocity, the physical and chemical properties of meteoroids, and so on. But, the dependencies have not been well studied.

We made a series of impact experiments simulating porous meteoroids impacting the lunar surface. The luminous energies of impact flashes were obtained by analyzing two photo-diode output signals and high-speed camera frames. The luminous efficiencies were then compared with those for the solid meteoroids. The efficiency was revealed to be much larger for the porous meteoroids than for the solid ones. It should be noted that the material we used, nylon 66, is not planetary material at all, and the impact velocity in our experiments, 6 km/s, is far less than the natural meteoroid velocities. The result is nevertheless concordant with a simple theoretical argument. We conclude that the lunar impact flashes would be observed much brighter by porous meteoroids than by solid ones.

Keywords: impact; meteoroid; impact flash; moon.

References

[1] M. Yanagisawa, K. Ohnishi, Y. Takamura, H. Masuda, Y. Sakai, M. Ida, M. Adachi and M. Ishida, *Icarus* **182**, 489 (2006).

[2] L. R. Bellot Rubio, J. L. Ortiz, and P. V. Sada, *Earth, Moon, Planets*, 82-83, 57 (2000).