## Is the Crater Diameter Ruled by Gravity? ~Experimental verification of the crater gravity scaling law ~

\*Ryota Iwamoto<sup>1</sup>, \*Keita Maishi<sup>2</sup>, \*Kyoya Okada<sup>2</sup>, \*Satoru Kitada<sup>3</sup>, \*Takuya Hanasaki<sup>3</sup>, \*Yuichiro Okuno<sup>3</sup>

1. Otemae Senior High School of Osaka Prefecture The evening course, 2. Kasugaoka Senior High School of Osaka Prefecture The evening course, 3. Imamiya Technology Senior High School of Osaka Prefecture The evening course

In this project, we investigated the crater formation on planets and satellites by making a distinctive apparatus to control gravity. Regarding the crater formation, it is known that the crater diameter D and the surface gravity  $g_{\text{eff}}$  is theoretically related by gravitational scaling law  $D \propto g_{\text{eff}}^{-0.25}$ . However, the experimental verification of the law is still insufficient due to the technical difficulties of changing gravity on the ground. Results of preceding experiments by NASA Ames Research Center (in 42 years ago) give D  $\propto g_{\text{eff}}^{-0.165 \pm 0.005}$ , and results by MGLAB give  $D \propto g_{\text{eff}}^{0.004 \pm 0.003}$ . Both of them are significantly different from the theoretical prediction. The purpose of this project is to clarify the relationship between the crater diameter and the surface gravity. In order to control the gravity inside a capsule, we created a microgravity generator using the free fall of the capsule and a gravity control apparatus using the Atwood pulley system. This system enables us to stably control the gravity in the falling capsule for about 0.5 seconds. We placed a target glass beads, a high-speed camera, and an electric gun inside the falling capsule. During the fall of the capsule, the formation of a crater on the glass beads by a bullet ejected from the electric gun was observed with the high-speed camera. As a result of the observation under various gravity, we figured out that the crater diameter and the gravity inside the capsule is related by  $D \propto g_{eff}^{-0.246}$ <sup>±0.009</sup>. The experimental result verified the gravitational scaling law. Now, we are planning to make use of this project to clarify the process of the crater formation under various gravity, that is important to clarify planet and exoplanet formation process, that is indispensable to understand the history of our planet.

Keywords: gravity control apparatus, crater formation, gravitational scaling law