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[U-06_28AM1]New Progress toward the Understanding of Small Solar System Bodies

Convener:*Masahiko Arakawa(Graduate School of Science, Kobe University), Taishi Nakamoto(Tokyo Institute of Technology), Sei-ichiro WATANABE(Division of Earth and Planetary Sciences, Graduate School of Science, Nagoya University), Masanao Abe(Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency), MASATERU ISHIGURO(Department of Physics and Astronomy, Seoul National University), Chair:Masahiko Arakawa(Graduate School of Science, Kobe University)

Mon. Apr 28, 2014 9:00 AM - 10:45 AM 503 (5F)

This session is aimed at setting up a forum to discuss how we can make progresses in our understanding of the solar system evolution with our hands on data. Presentations related to the science of the small bodies in the solar system (satellites, asteroids, comets, interplanetary dust particles, trans-Neptunian objects, and planetesimals) are invited. In addition to the extensive astronomical/remote-sensing observations and theoretical works, Hayabusa has brought us samples back from Itokawa (S-type asteroid) for unprecedentedly detailed analysis. The results of the Hayabusa sample initial analysis do prove that analysis of returned samples will play a key role in our future study of the solar system evolution. While the mission preparation of Hayabusa2, which is targeted at a more primordial asteroid than Itokawa (1999JU3, C-type), is being matured, expectation of building a new gateway to biology-flavored topics via organic material and aqueous alteration analysis is ramping up. In this session, after summarizing the cutting-edge results obtained by various studies, including the impact physics important for the asteroid evolution, we will discuss the future shape of the study of the solar system evolution.

10:30 AM - 10:45 AM

[U06-P08_PG]Impact crater formation on quartz sand: the effect of projectile density on ejecta velocity distributions

3-min talk in an oral session

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Introduction : Regolith formation and surface evolution on asteroid are caused by high velocity impacts of small bodies. The ejecta velocity distribution is one of the most important physical properties related to the crater formation and it is necessary to reconstruct the planetary accretion process among planetesimals. The surface of small bodies in the solar system has a various property on the porosity, strength and density. Therefore, the impact experiment on the target with the various properties is necessary to clarify the crater formation process applicable to the small bodies in the solar system. However, there have not enough studies on the effect of projectile density on the ejecta velocity distribution. Therefore, we would try to determine the effect of projectile density on the ejecta velocity distribution using 8 projectiles with different density by means of the observation of the each ejecta grain. Experimental method: The cratering experiment was made by using a vertical type one-stage light gas gun (V-LGG) set at Kobe Univ. We used 3 types of targets: that is, they are the 100micron-glass beads target (porosity 37.6%), the 500 micron-glass beads target (porosity 37.6%), and 500-micron quartz sand (porosity 44.7%). These granular materials were put into the stainless steel container with the diameter of 30cm and the depth of 11cm. The target container was set in a large chamber with the air pressure less than 10^3 Pa or 10^5Pa. The material of the projectile that we used was a lead, a copper, an iron, a titanium, a zirconia, an alumina, a glass, and a nylon (1.1-11.3g/cm^3), and it had a diameter of 3mm and was launched at the impact velocity (v_*) of 24 to 217m/s. We made an impact experiment using 8 types of projectiles on the 500-micron quartz sand target and observed each ejecta grain by using a high speed digital video camera taken at 2000-10000 FPS. Then, we measured the ejection velocity and the initial position of each grain. We successfully obtained the relationship between the initial position and the initial ejection velocity or ejection angle for the quartz sand grains.Result: In (Eq.1), mu is proportional to density of projectile in the range less than 6g/cm^3. (Eq.2)v_e/v_=a$(x/R)^{(-1/mu)}$?(1), where ve is an ejection velocity of grain, x is the initial position of ejecting quartz sand grains and R is the crater radius. mu=0.05ρ+038 -(2)Moreover, we obtain the relation between crater size and projectile density.(Eq.3)[R*(ρ t/m)^(1/3)]=11*[ρ t/ρ p]^0.096 ?Eq(3)The ejection angle of quartz sand grains is also obtained. For all projectiles, the grain that ejects from near impact point have high ejection angle and the more distant that grain ejects from, the lower the eject angle is. There are no effect of projectile density.The obtained empirical equation between the ejection velocity and the initial position is as follows Eq(4),ve/vi=1.5*$10^{-3}$$(x/R)^{-1.8}$ (0.3< x/R <0.9) -(4)*