Interpretation on Deep Impact results

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Cometary nuclei are expected to have important information on the conditions of the solar nebula [1]. However, since aging processes have altered nuclei, we cannot readily obtain such information from the present state of comets [2]. Thus, it is extremely important to know the present internal structure, particularly, near-surface structure, because this will help us to understand the cometary aging processes [2]. Nevertheless, our understanding of cometary subsurface structure has remained poor; there have been no direct method to observe their interiors. In 2005, NASA's Deep Impact (DI) probe was successfully collided with comet 9P/Tempel 1 [3]. This provided the first chance to directly investigate the cometary internal structure. Here, on the basis of our ground-based observations of the DI event, we report that the comet has a surface layer consisting of small (sub-micron to microns) carbonaceous grains and that the thickness is several tens of cm [4]. Since the onboard cameras of the DI spacecraft could not observe the inside of the crater, this is the first quantitative observational result on comet interior. Our result suggests that the surface of 9P/Tempel 1 near the DI impact site is formed in the trans-Neptunian region. This further implies that many short period comets may have material that has not been metamorphosed since they left the trans-Neptunian region at ~ 1 m of depth even after numerous perihelion passages.

Keywords: Comet; Deep Impact; Mid Infrared.

References

[1] S. J. Weidenschilling, in *Comet II* (eds Festou, M. C., Keller, H. U., & Weaver, H. A.) 97-104 (Univ. Arizona press, Tucson, 2004).
[2] K. J. Meech & J. Svoren, in *Comet II* (eds Festou, M. C., Keller, H. U., & Weaver, H. A.) 317-335 (Univ. Arizona press, Tucson, 2004).
[3] M. F. A'Hearn *et al.*, *Science* **310**, 258-264 (2005).
[4] T. Kadono *et al., Astrophys. J. Lett.*, **661**, L89-L92 (2007).