THERMAL INFRARED OBSERVATIONS OF ASTEROID 2005YU55 DURING CLOSET APPROACH.

T. Miyata[1], T. G. Mueller[2], S. Hasegawa[3], S. Sako[1], T. Kamizuka[1], T. Nakamura[1], K. Asano[1], M. Uchiyama[1], M. Konishi[1], M. Yoneda[4], T. Ootsubo[5], F. Usui[3], B. Altieri[6], M. Kidger[6], Y. Yoshii[1], M. Doi[1], K. Kohno[1], K. Kawara[1], M. Tanaka[1], K. Motohara[1], T. Tanabe[1], T. Minezaki[1], T. Morokuma[1], Y. Tamura[1], T. Aoki[7], T. Soyano[7], K. Tarusawa[7], S. Koshida[1], H. Takahashi[1], and N. Kato[1]

[1]Institute of Astronomy, School of Science, the University of Tokyo, 2-21-1 Osawa, Mitaka, Tokyo 181-0015, Japan, [2]Max-Planck-Institut fur extraterrestrische Physik, [3]Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency, [4]Planetary Plasma and Atmospheric Research Center, Graduate School of Science, Tohoku University, [5]Astronomical Institute, Graduate School of Science, Tohoku University, [6]Herschel Science Centre, European Space Astronomy Centre, [7]Kiso Observatory, Institute of Astronomy, School of Science, the University of Tokyo

Introduction: Asteroid 2005YU55 was made an exceptionally close approach to the Earth, passing within 0.0217 AU (325,000 KM) on 2011-Nov-08 23:24. Such a closet approach was incredibly rare event and a valuable opportunity to study near earth asteroids in detail.

Observations: The asteroid 2005 YU55 was observed with a mid-infrared camera MAX38 ([1], [2], [3]). MAX38 has a 128x128 Si:Sb BIB detector with a pixel scale of 1.26 arcsec and a field of view of 2x2.5 arcmin, and attached on the mini-TAO 1 meter telescope ([4]) which is the highest (altitude of 5,640m) telescope in the world.

The observations were carried out from 2011-Nov-08 23:04 to 25:51 and Nov-09 23:56 to 26:04. It covered the closet approaching time and 24 hours later to the approach. Bandpass filters at 8.9 micron (width: 0.9 micron), 12.2 micron (0.5 micron), and 18.7 micron (0.9 micron) were used. The weather condition was excellent.

Since the distance to the asteroid from the Earth was very short, the asteroid apparently moved very fast on the sky. We pointed the telescope at repeated intervals to follow the asteroid movement. The intervals were set to 1 minute and 3 minutes on Nov. 8 and 9, respectively. Normal sidereal tracking was applied in the period between the telescope pointings. Images were taken at a frame rate of 3.8 Hz with an effective integration time of 0.197 sec. The frame rate is fast enough not to extend the image of the asteroid on each frame. Chopping technique was not applied because background can be canceled out with using frames just before or after an object frame.

Results: Lightcurves at the 8.9, 12.2, and 18.7 micron bands with sufficiently signal-to-noise ratio were successfully obtained. The brightness at 18.7 micron apparently increased from 190Jy at t (time from the closet approach) = -20 min to 260Jy at t = 60 min. It decreased to 230Jy at t = 120min. The brightness peak seems to be located around t = 90 min while it was not practically observed. Similar tendency can be seen in the brightness at 12.2 micron, which slightly decreased at t = 100 -- 120 min.

On Nov. 9, the asteroid became approximately one-sixth fainter than that on Nov. 8 at both 8.9 and 18.7 microns. This was mainly caused by changing Earth-asteroid distance.

Thermophysical Modeling : Photometric data in the thermal infrared wavelength range are very useful for modeling the asteroid. We are now applying thermophysical model (TPM, [5]) for the asteroid. Far-infrared data at 70 and 160 micron obtained by Hershell/PACS ([6]) are also used. It provides better information of size, shape, spin-vector orientation, thermal inertia, and so on.

References: [1] Miyata T. et al. (2008) Proc. SPIE 701428, [2] Nakamura T. et al. (2010), Proc. SPIE 70184H, [3] Asano K., et al. (2012) Proc. SPIE in prep., [4] Sako S. et al. (2008) Proc. SPIE 70122T, [5] Mueller T. G. & Lagerros, J. S. V. 1998, A&A 338, 340 [6] Mueller et al. (2011), IAUC 9241