KECK ADAPTIVE-OPTICS IMAGING OF NEAR-EARTH ASTEROID 2005_YU55 DURING ITS 2011 CLOSE FLYBY. W. J. Merline[1,] J. D. Drummond[2], P. M. Tamblyn[1], C. Neyman[3], B. Carry[4], A. R. Conrad[5], C. R. Chapman[1], J. C. Christou[6], C. Dumas[7], B. L. Enke[1], [1]Southwest Research Institute, 1050 Walnut St. #300, Boulder, CO 80302 USA (merline@boulder.swri.edu), [2]Air Force Research Lab, Kirtland AFB, NM USA, [3]W. M. Keck Observatory, Kamuela, HI USA, [4]European Space Astronomy Centre, ESA, Madrid, Spain, [5]Max Planck Institute fur Astronomy, Heidelberg, Germany, [6]Gemini Observatory, Hilo, HI USA, [7]European Southern Observatory, Santiago, Chile.

Introduction: We report on adaptive-optics (AO) imaging of the Near-Earth Asteroid (NEA) 2005_YU55 during its close fly-by on 2011 Nov 9 UT. We made observantions with the Keck II AO system NIRC2. Our goals were to make independent measurements of the size, shape, and spin-pole orientation of the asteroid and compare them with those obtained by other methods, and to search for satellites. Potentially, direct imaging observations can give complementary information to those obtained by, for example, radar. This was part of a larger campaign of many different types of observing modes that were all directed toward this object on, or near, its closest approach.

Technique: We had previously demonstrated our ability to image NEAs with AO on large telescopes, specifically Keck, when we were able to image the close binary (35107) 1991_VH on 2008 Aug 9 UT (see Merline et al. 2008, IAU Circular 8977). There, we imaged a close binary at separation only 0.08” or about 3 km. Despite many many additional attempts, we have not been able to definitively resolve any NEA, however, until the 2005_YU55 event. Our methods of size, shape, and pole determination have been described during our successful efforts to derive these parameters for (21) Lutetia, using ground-based data, before the flyby of Rosetta. Drummond et al. (2010 A&A, 523, A93) demonstrates the utility of fitting using a triaxial assumption, while Carry et al. (2010, A&A, 523, A94) provides details on fitting a detailed 3D model to an asteroid using our new technique KOALA, which combines lightcurve, AO, and occultation data into one solution.

Circumstances: Unfortunately, our observations were delayed by two precious hours by fog, so we did not get all the time we had hoped on this object, despite having the telescope on the night of close approach. Our observations started at 7:15 UT, when the range to the object was 0.00332 AU with solar phase angle 44 deg. The asteroid was at magnitude V=11.1, with an angular size (of the approximately 88% illuminated disk) of about 0.12”. The images span 2.8 hr, until 10:03 UT (range 0.00407 AU; phase 36 deg). The object was sufficiently bright to guide under natural guide star conditions, using the asteroid as the guide source for the AO. We observed in both Kp and H bands. We did not have trouble locking the AO on this very fast-moving object. Our observations were webcast live by Keck Obsertory as a special event and we had over 20,000 viewers.

Preliminary Results: These data were used to derive dimensions under assumptions of a smooth triaxial ellipsoid, having principal-axis rotation with spin period 18 hr (from the JPL Small-Body Database). Two possible poles came out of our initial solution. We showed a preference for a prograde pole, having triaxial diameters of 337 x 324 x 267 m, with estimated uncertainties of 15 m in each dimension; pole towards R.A.= 282 deg, Decl. = +64 deg (equinox 2000.0; uncertainty radius about 6 deg), or ecliptic lambda = 339 deg, beta = +84 deg. The resulting spherical-equivalent diameter is then 308 m ± 9 m. The retrograde pole was toward R.A. = 34 deg, Decl. = -24 deg (uncertainty radius 15 deg), or ecliptic lambda = 22 deg, beta = -35 deg, with dimensions 328 x 312 x 245 m (uncertainties of 15, 15, 30 m) and a spherical-equivalent diameter of 293 ± 14 m. Deviations from the ellipsoidal shape are evident. Solutions are also obtained by allowing a shorter spin period, but a shorter period is not being asserted here. No satellites typical of near-earth objects were evident in this initial analysis (here covering magnitude differences < 3 and orbit radius > 3 radii) of 2005 YU_55.

Improved solutions: Further work shows that other pole positions are also viable. We initially overlooked poles in the southern sub-latitudes that appear to be favored over our northern solution. Our new preferred solution yields a diameter of 307 +/- 15 km, with a southern rotational pole, meaning that the asteroid presented a warm terminator during its close approach. Our intention is to combine this also with lightcurve observations as part of our KOALA technique to derive size, shape, and pole, and then to validate it against the presumably more robust radar observations. We will continue to understand ambiguities and systematics in our approach and we will discuss these at the meeting and present our latest values for the asteroid parameters.