Results from ground-based observations of asteroid 2012 DA_{14} during its close approach to the Earth on February 15, 2013

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Near-Earth asteroid 2012 DA_{14} (hereafter DA_{14}) made its closest approach to the Earth on February 15, 2013, when it passed at a distance of 27,700 km from the Earth's surface. DA_{14} was discovered only one year before the approach. This fact, together with its small size, made a good characterization of the body very difficult. However, it was the first time an asteroid of moderate size ($\sim$45 m estimated before the approach) was predicted to come that close to the Earth, becoming bright enough to permit a detailed study from ground-based telescopes.

With the aim of collecting the most varied and useful information, we designed and carried out an observational campaign that involved 5 ground-based telescopes located in 4 different Spanish observatories. Visible colors and spectra were obtained using the 10.4-m Gran Telescopio Canarias (GTC) at the "El Roque de los Muchachos" Observatory (ORM) and the 2.2-m CAHA telescope in Calar Alto Observatory (Almeria); near-infrared colors were obtained using the 3.6-m Telescopio Nazionale Galileo, located also at the ORM; time-series photometry was obtained using the f/3 0.77-m telescope at La Hita Observatory (Toledo) and the f/8 1.5-m telescope at the Sierra Nevada Observatory (Granada, Spain).

The analysis of the data confirmed that this NEA can be classified as an L-type asteroid with an estimated geometric albedo of $p_V = 0.44 \pm 0.20$. L-type asteroids are not very common and most of them display unusual characteristics that indicate that their surfaces could be covered by a mixture of high- and low-albedo particles, as it is detected on some carbonaceous chondrites (CV3 and CO3). We found the asteroid to be quite elongated and very irregular, with an equivalent diameter of 18 m, less than a half of the former estimation. This suggests that close approaches of objects as small as DA_{14} are 4 times more frequent per year than it was thought before (once every 40 years). The rotational period of the object was also estimated with high accuracy with interesting results. Using the time-series photometry before and after the encounter, we show that the object probably suffered a spin-up due to the gravitational forces during its close approach to the Earth, decreasing its rotational period from 9.8 ± 0.1 hr. to 8.8 ± 0.1 hr.