Apophis: Larger and much heavier than previously thought

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The near-Earth asteroid (99942) Apophis is a potentially hazardous asteroid. We obtained far-infrared observations of this asteroid with the Herschel Space Observatory's PACS instrument at 70, 100, and 160 micron. These were taken at two epochs in January and March 2013 during a close Earth encounter. These first thermal measurements of Apophis were taken at similar phase angles before and after opposition. We performed a full radiometric analysis via a thermophysical model using as input the shape and spin properties derived by Pravec et al. (2014) [1]. We find that the tumbling asteroid Apophis has an elongated shape with a mean diameter of slightly below 400 m (of an equal volume sphere) and a geometric V-band albedo of around 0.3. We find a relatively high thermal inertia, which can be explained by a mixture of low conductivity fine regolith with larger rocks and boulders of high thermal inertia on the surface. The thermal inertia and other similarities with (25143) Itokawa indicate that Apophis might also have a rubble-pile structure. If we combine the new size value with the assumption of an Itokawa-like density and porosity we estimate a mass which is about 2–3 times larger than previous estimates. We expect that the newly derived properties will influence impact-scenario studies and influence the long-term orbit predictions of Apophis.

References: [1] Pravec, P. Scheirich, P., Durech, J. et al. 2014: The tumbling spin state of (99942) Apophis, Icarus, 233, 48.