

Egyptology

A new chamber has been detected in the Great Pyramid of Giza

Muons from cosmic rays illuminated it



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ANCIENT Egypt has held the world in thrall for so long that some of those once enthralled are now ancient history themselves. Well-to-do Romans of the early Empire, for instance, would tour the place to look at antiquities older to them than the Colosseum is to a tourist today. Yet Egypt keeps secrets still. Its royal tombs, both those underground and the skyward-reaching pyramids, are rife with stories of hidden chambers. And, in the most famous tomb of all, the Great Pyramid of Giza, one such has just been shown to be real.

It was discovered by Kunihiro Morishima of Nagoya University, in Japan, and his colleagues. They searched not by the time-honoured archaeological techniques of

digging with trowels and knocking down walls with hammers, but by muon tomography—an esoteric way of looking inside things using the fallout from cosmic rays that have hit Earth’s atmosphere. Muons are heavy kin to electrons. They are able to penetrate solid matter to some degree, but are eventually absorbed by it. By measuring the absorption rate of muons travelling in different directions through a large object, such as a pyramid, it is possible to work out if there is an empty space within. By suitable triangulation, it is then possible to work out where that empty space is. And this, as they describe in a paper in *Nature*, is what Dr Morishima and his colleagues have done for the Great Pyramid.

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The pyramid itself, the last-standing of the Seven Wonders of the Ancient World, was built around 2560BC by Khufu, a pharaoh better known in the West by his Hellenised name, Cheops. Several of its internal chambers, including the Queen’s chamber, the King’s chamber and the Grand Gallery, were robbed in antiquity, and excavated more systematically in the 19th and 20th centuries by various archaeologists. But there has always been a suspicion that, in

such a huge pile of stone, more chambers exist—perhaps un plundered.

To look for such chambers Dr Morishima and his colleagues deployed three sorts of muon detector in various places in and around the pyramid. One type were nuclear emulsion films. These are photographic films which capture the tracks of muons passing through them. The second were scintillator hodoscopes. These are made of material that gives off light as a muon passes—again allowing its path to be followed. The third type of instrument, micropattern gaseous detectors, follow the passage of muons from the trails of ionised gas they leave behind.

Combining the results of these approaches revealed a void inside the pyramid some 30 metres long, with about the same volume (800 cubic metres or so) as the Grand Gallery. Its centre is 40-50 metres north of the Queen’s chamber. Muon tomography is a low-resolution technique, so the exact shape of this void—or even whether it is actually several smaller voids in proximity to one another—remains to be determined. But it is clearly a large space.

How to examine it in more detail also remains to be determined. Drilling into such an important monument to get at the newly discovered void is out of the question. Camera probes inserted into shafts within the pyramid that are unsafe for human entry have found things that may or may not be unopened doors, but none would debouch directly into the newly discovered space. Muon tomography is not, at the moment, sensitive enough to see such shafts, so unknown ones would not have shown up on Dr Morishima's survey. Presumably there is, somewhere in the pyramid, a corridor of some sort that leads to the new void. But that is still on the list of unrevealed Ancient Egyptian secrets.

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