Astronomers spot record-breaking lunar impact

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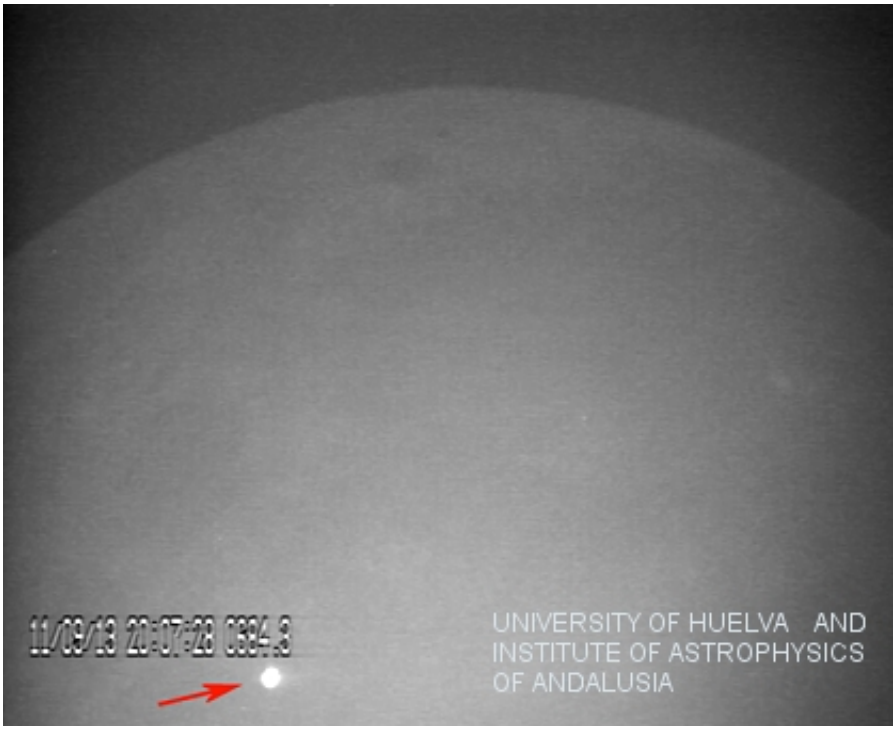

An image of the flash resulting from the impact of a large meteorite on the lunar surface on 11 September 2013, obtained with the MIDAS observatory. Credit: J. Madiedo / MIDAS

A meteorite with the mass of a small car crashed into the Moon last September, according to Spanish astronomers. The impact, the biggest seen to date, produced a bright flash and would have been easy to spot from the Earth. The scientists publish their description of the event in

the journal *Monthly Notices of the Royal Astronomical Society*.

The Moon lacks the atmosphere that prevents small rocks from space from reaching the surface of the Earth. The result is very visible – vast numbers of craters large and small cover the whole of our nearest neighbour and record 4.5 billion years of collisions that span the history of the Solar system.

Although there is almost no chance of a very large object striking the Moon or planets, collisions with smaller objects are very common even today. The odds of seeing one of these by chance are pretty poor, so scientists have set up networks of telescopes that can detect them automatically.

On 11 September 2013, Prof Jose M. Madiedo was operating two telescopes in the south of Spain that were searching for these impact events. At 2007 GMT he witnessed an unusually long and bright flash in Mare Nubium, an ancient lava-filled basin with a darker appearance than its surroundings.

The flash was the result of a rock crashing into the lunar surface and was briefly almost as bright as the familiar Pole Star, meaning that anyone on Earth who was lucky enough to be looking at the Moon at that moment would have been able to see it. In the video recording made by Prof Madiedo, an afterglow remained visible for a further eight seconds.

The October event is the longest and brightest confirmed impact flash ever observed on the Moon. Prof Madiedo recalls how impressed he was: "At that moment I realised that I had seen a very rare and extraordinary event."

The Spanish telescopes are part of the Moon Impacts Detection and Analysis System (MIDAS) system that monitors the lunar surface. This

project is being undertaken by Prof Jose Maria Madiedo, from the University of Huelva (UHU), and by Dr Jose L. Ortiz, from the Institute of Astrophysics of Andalusia (IAA-CSIC) and continues a pioneering program that detected sporadic lunar impact flashes for the first time.

Since these impacts take place at huge speeds, the rocks become molten and are vaporised at the impact site instantaneously, and this produces a thermal glow that can be detected from our planet as short-duration flashes through telescopes. Generally, these flashes last just a fraction of a second. But the flash detected on 11 September was much more intense and longer than anything observed before.

Prof Madiedo and Dr Ortiz think that the flash was produced by an impactor of around 400 kg with a width of between 0.6 and 1.4 metres. The rock hit Mare Nubium at about 61,000 kilometres per hour and created a new crater with a diameter of around 40 metres. The impact energy was equivalent to an explosion of roughly 15 tons of TNT, at least three times higher than the largest previously seen event observed by NASA in March last year.

"Our telescopes will continue observing the Moon as our meteor cameras monitor the Earth's atmosphere. In this way we expect to identify clusters of rocks that could give rise to common impact events on both planetary bodies. We also want to find out where the impacting bodies come from."

Observing impacts on the Moon gives astronomers an insight into the risk of similar (but larger) objects hitting the Earth. One of the conclusions of the Spanish team is that these one metre sized objects may strike our planet about ten times as often as scientist previously thought. Fortunately, the Earth's atmosphere shields us from rocks as small as the one that hit Mare Nubium, but they can lead to spectacular 'fireball' meteors.

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