

Recent UK fireball could not have 'skipped' around the world, new analysis says (Update)

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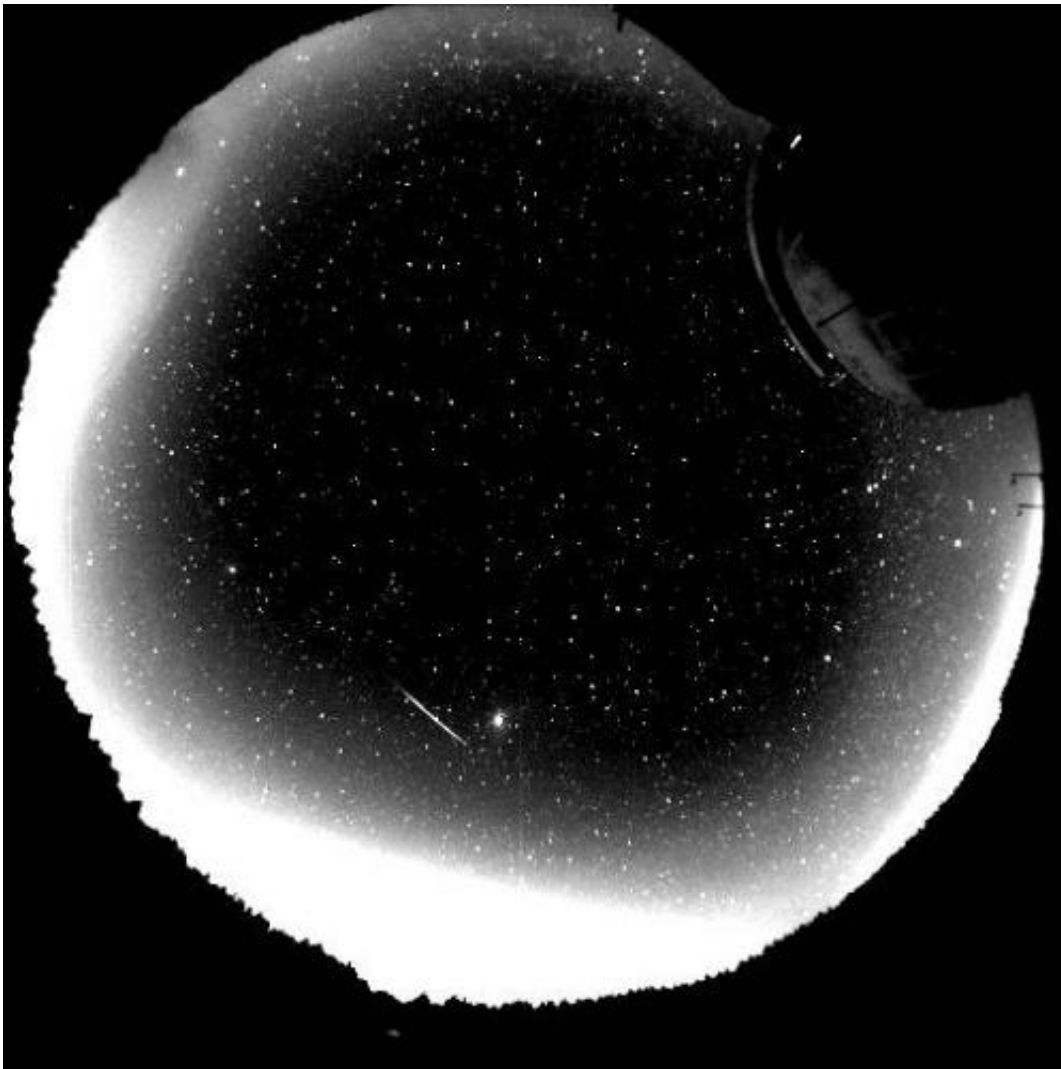


Image of fireball taken on Feb. 25, 2004 by the Elginfield CCD camera from the University of Western Ontario.

The meteoroid [seen over the UK](#) on September 21, 2012 has created quite a sensation – make that a several sensations. First, the bright object(s) in the night sky were seen across a wide area by many people, and the brightness and duration – 40 to 60 seconds reported and videoed by some observers – had some experts wondering if the slow moving light-show might have been caused by space junk. But analysis by [satellite tracker](#) Marco Langbroek revealed this was likely an Aten asteroid, asteroid which have orbits that often cross the Earth's orbit, but their average distance from the Sun is less than 1 AU, the distance from the Earth to the Sun.

Atens are fairly unusual, making this a rather unique event. But then came another analysis that seemed to be so crazy, it might have been true: this meteoroid may have skipped like a stone in and out of Earth's atmosphere, where it slowed enough to orbit the Earth until appearing as another meteor over Canada, just a few hours after it was seen over the UK and northern Europe.

How amazing that would have been! And there was much speculation about this possibility. But, it turns out, after more details emerged and further investigation ensued, it is not possible that the space rock could have boomeranged around the world and been seen in again 2½ hours later over Canada. However, the current thinking is that at least one or two of the largest pieces retained enough velocity that they went into an elliptical Earth orbit, and went perhaps a half an orbit around Earth.

"At first it seemed natural to consider a possible dynamical linkage (between the UK and Canadian meteors), partly because the precise location and time over Quebec/Ontario was not well-known early on," said aerospace engineer and meteor expert Robert Matson, in an email to Universe Today. Matson worked extensively with Esko Lyytinen, a member of the Finnish Fireball Working Group of the Ursa Astronomical Association, to analyze the possible connection between

the September 21 UK fireball, and the Quebec fireball that followed about 2½ hours later.

At first, the time of the fireball sighting over southeastern Canada and northeastern USA was in doubt, but two Canadian all-sky cameras from the [Western Meteor Physics Group](#) captured the meteor, providing an accurate time.

"And once I triangulated the location to a spot between Ottawa and Montreal, a linkage to the UK fireball was no longer possible due to the longitude mismatch," Matson said.

Additionally, the 153-minute time difference between meteors places a strict limit on the maximum longitude difference for a "skipping" meteoroid of roughly 38 degrees. This would put the final perigee well off the coast of Newfoundland, south of Greenland, Matson added.

More facts emerged, putting a death knoll on the connection between the two.

"Independent of the longitude mismatch, triangulation of the Canadian videos revealed that the entry angle was quite steep over Quebec – quite at odds with what an orbiting remnant from a prior encounter would have had," Matson said. "So the meteors are not only unrelated, their respective asteroid sources would have been in different solar orbits."

Another duo of astronomers from the British Astronomical Association, John Mason and Nick James concurred, also noting the shallow angle of the UK fireball, in addition to its slow speed. "We get velocities of 7.8 and 8.5 km/s and a height of 62 km ascending," they wrote in the [BAA blog](#). "These velocities and the track orientation and position are not at all consistent with ongoing speculation that there is a connection between this fireball and a fireball seen in south-eastern Canada/north-eastern

USA 155 minutes later."

But did parts of the meteoroid survive and skip out of the atmosphere? "Nearly all of the fragments of the meteoroid did just come in for good during and shortly after the UK passage, but at least one or two of the largest pieces retained enough velocity that they went into elliptical earth orbit," Matson said. "The perigee of that orbit was a little over 50 km above the UK. The apogee would have been half an orbit later, possibly thousands of kilometers above the South Pacific, south of New Zealand."

Just how high the apogee altitude was depends on how much the meteoroid decelerated over the UK, Matson added.

"This is why Esko, myself and others are very interested in determining the velocity of those fragments after they passed through perigee," he said. "Below 7.9 km/sec, and they never get back out of the atmosphere; between 7.9 and 11.2 km/sec, they go into orbit—and we believe a couple of the biggest pieces were in the lower half of this range."

But Matson said that if any remnant or remnants of the UK fireball did "skip" out of the atmosphere, they certainly had to come back in for good somewhere on the planet. "It is even remotely possible that it happened over Quebec," Matson said. "But the laws of orbital mechanics do not allow an aerobraked fragment of the UK meteoroid to reenter over Quebec only 2½ hours later. It would have to be more than 4 hours later to line up with Quebec."

The most likely scenario, Matson said, is that the surviving portion(s) of the UK meteoroid came in for good less than 2½ hours later, with the only possible locations during that window being the North Atlantic, Florida, Cuba, Central America, the Pacific, New Zealand, Australia, the Indian Ocean, the Arabian Peninsula, Turkey or southern Europe. Of

these, the northern hemisphere locations would be favored.

So perhaps we haven't heard the last of this meteoroid!

As crazy as the bouncing bolide sounds, it has happened in the past, according to [Kelly Beatty at Sky and Telescope](#), who mentioned at least one instance where a large meteoroid streaked across the sky and then returned to interplanetary space. This sighting took place over the Rocky Mountains in broad daylight on August 10, 1972, and the meteoroid came as close as 35 miles (57 km) above Earth's surface before skipping out into space. Beatty added that its velocity was too fast to become captured and return again.

You can read more analysis of the UK fireball being an Aten asteroid by [Phil Plait at Bad Astronomy](#).

Source: [Universe Today](#)

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