Observing meteors

NZASE news article

Since the end of June, 2023, Western Heights High School (WHHS) in Rotorua has been operating a meteor camera. How did they get it and what is it used for? NZASE Science Communicator Mike Stone investigates.

Mātauranga Māori

Māori narratives and beliefs include many records referring to meteors. Meteor names vary from region to region, and include matakōkiri, kōtiri, kōtiritiri and tamarau.

Meteors were generally seen as omens. Bright meteors denoted good omens for future weather or crops, while fainter ones denoted evil omens; eg, foretelling the death of a chief.

Māori interpreted meteors in several ways – they were thought to bring fire to Earth, or to be stars that the sun or moon had struck down. They were also viewed as personifications of atua or ancestors, such as Tūmatakōkiri and Rongomai, a name also used to refer to Halley's Comet.

Stories tell of an association between fire, the disappearance of the moa and a falling object. One of the ancient names for the moa, manu whakatau, can be translated as bird felled by strange fire.

Science of meteors

Meteorites begin life as asteroids (large rocks) or comets (rocky snowballs) that break up. When these fragments enter our atmosphere travelling at speed, they start to burn.

But this is not due to friction, as many think. The fragments burn because they compress air in front of them, since it cannot get out of the way fast enough.

Compressing aerosols heats them, and it is this heat that then melts the rock. What we see is a fireball or shooting star streaking across the sky – the meteor. Any part that hits the ground is called a meteorite.

Meteor camera at Dunstan High School in Alexandra, by James Scott, UoO.

Image from the Western Heights High School camera, July 12, 2023.

Meteorites are rocks, but they are unlike the rocks on Earth. Firstly, they are bright and black when freshly found, due to their surface melting and then crystallising as a glass. Meteorites are also much older than Earth rocks, and provide samples of asteroids, comets, and the surface of other planets or moons.

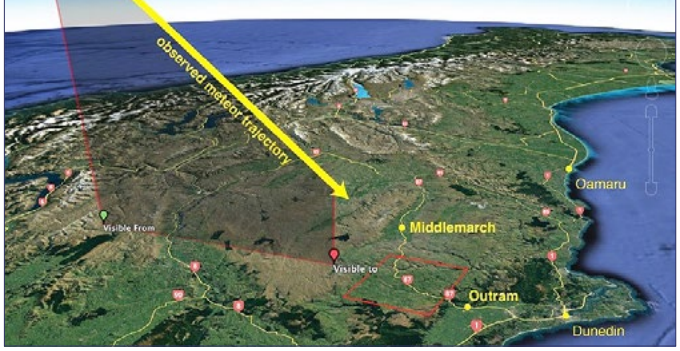
All meteorites come from inside our Solar System, most from the asteroids between Mars and Jupiter. They can tell us about the history of our Solar System, how it began and how planets and asteroids formed and evolved.

Their density and composition, combined with their paths through the atmosphere, help us understand more about the physics of meteorite impacts here on Earth.

In 2016 NASA launched a spacecraft to sample Bennu asteroid. In Hepetema 2023, a capsule landed carrying 250g of Bennu's material. Its analysis will add to the picture of space we are compiling from meteorites.

The main season for viewing meteors is in November when the Leonid meteors (debris from Comet Tempel-Tuttle) streak across the sky, with more than 100 visible per hour from NZ. The Geminids (from the Phaethon asteroid) arrive in December at a similar rate.

Although it is estimated that up to four meteorites greater than 100g land on Aotearoa each year, only nine have been found in 160 years of reporting, and scientists



Left: Fireball over Otago, August 28, 2022; image from Dunstan High School camera. Centre: Trajectory of that fireball, calculated from available cameras. Right: Otago meteorite hunt near Middlemarch, September 2022. All images by James Scott, University of Otago.

want to find more. However, most metorites are very small and many land in water.

Studying meteors

James Scott is a University of Otago Geology professor with an interest in meteorites. He is part of a group called Fireballs Aotearoa which aims to recover freshly fallen meteorites.

James secured funding from the Astronomical Society; the Geoscience Society; Otago Science into Action, part of the Curious Minds participatory science platform; and UK-based computing company Raspberry Pi.

With this, James and his students bought the parts, assembled meteor cameras and distributed them free around the country. These days they sell unassembled cameras and assembled ones for about $550.

When mounted, the camera is carefully aligned to a particular direction. The camera's location is known precisely, and it is calibrated to the stars that it sees in its field of view, so that it records meteor locations very accurately.

Each camera is connected to a Raspberry Pi computer, which processes the night's viewing and transmits data to the University of Western Ontario in Canada.

Here the Global Meteor Network amalgamates data from other cameras viewing the same bit of sky from different angles, to give very accurate data about a meteor's altitude, speed and direction of travel. This can help scientists pinpoint where it may have landed.

In schools

Alison Scott teaches at Rotorua's Western Heights High School (WHHS). Since the end of June 2023, WHHS has been operating a meteor camera as part of the Global Meteor Network.

Her dad, Peter McKellar, who had one set up at home, obtained and set up a free camera for Alison's school. On July 12 at 4.53am they captured their first image.

This camera scans the sky to the southwest of the school at 25 frames per second. See WHHS data with the ID NZ002K.

While WHHS has yet to include meteors into the Yr 9 astronomy programme, Alison is hopeful the new NCEA standards will be flexible enough for her to include a study of meteor data in L1 Science.

References

Abbey Donaldson, 2023, NASA's Bennu asteroid sample contains carbon, water.

RNZ, 2022, Race to find space rock near Dunedin: 'A loud sonic boom followed the fireball'.

Britton & Hamacher, 2013, Meteors in the Maori astronomical traditions of New Zealand, *Journal of the International Meteor Organization, 42*:1, p. 31-34.

Cam 6 – a three-camera set that is part of the meteor filming network, on top of Deer Park Heights, Queenstown. By James Scott, UoO.

This article benefitted from critique by Ross Stephen.

Ngā Kupu

Aorangi iti – Asteroid
Atua – Supernatural being/s
Kōtua – Bad omen
Mātai arorangi – Astronomy
Matakōkiri – Meteorite
Pū whakaahua matihiko – Digital camera
Raraunga – Data
Rerenga o Tamanuiterā – Solar System
Tāhei Aorangi Iti – Asteroid Belt
Tāmaki – Omen, portent.

Te Aka Māori Dictionary and *Paekupu*