February 2019 lecture review by Richard Godley

Speaker : **Nick Quinn, BAA Network for Meteor Triangulation and Orbit Determination**

Subject : **Amateur Meteor Studies in the 21st Century**

Nick has carried out meteor observations for many years and is a former WAS member. He dedicated this talk to Neil Bone, the director of the BAA meteor section for many years, who sadly died 10 years ago at a relatively young age. He was a great visual observer of meteors.

The field of meteor observing has come a long way in the past 30 years. In the 20th century meteor observation was visual. People would look up at the sky and count the meteors seen and could estimate the brightness of an individual meteor. A group of people looking in different directions could cover the whole sky and therefore it was possible to calculate the Zenithal Hourly Rate (ZHR) of the shower, and the path of the meteor could be plotted in a rudimentary way to establish the radiant. Therefore it could be determined which shower, if any, the meteor belonged to.

This could be supplemented by photographing parts of the sky during a shower. If you used a whole roll of film, taking 36 shots, you might get one photograph that included a meteor, if you were lucky. The use of digital cameras has improved this to the extent that you can quickly tell whether there is a meteor in any individual image and delete the image if there is nothing worth keeping. Digital photography has proved much more useful in determining the track of meteors. At the end of the 20th century image intensifiers were just coming into use.

In the current century the use of video to record meteors has transformed observation. Low-light CCTV cameras are very useful. Nick uses a Watec camera, which can pick up light sources with a brightness of just 0.0001 lux, and is ideal for astronomy. Fast lenses, such as with a focal ratio of f0.8 to f1.0 are ideal. Actually, more sensitive cameras to some extent remove the need for very fast lenses.

A computer is essential, and Windows is the obvious choice. Video Capture software is essential, too. Nick uses software from a Japanese company, SonataCo. You need a video capture card or dongle. You also need an accurate time source, particularly if you are going to become part of a network of meteor recorders, in order to coordinate your observations with those of others.

Nick uses one camera pointing up at the sky - not the normal direction cameras are pointed, because most use such cameras for security purposes. In the case of meteor recording the camera must therefore be rainproof.

The video capture software that Nick uses is called UFO Capture. This takes in a video stream, buffering it at about 5 seconds a time, and it can detect whether there is any movement from frame to frame.

You can use the settings to eliminate the sort of slow movement you don't need, such as planes or satellites flying over, or birds, and by setting the latitude and longitude of the camera the software can also know what stars are in the frame at the time and ignore the slow movement of those stars. Anything moving fast enough to be significant, which may include lightning or aurorae as well as meteors, can be saved to a file for later analysis. Nick showed a video of meteors his set-up had captured.

Nick's camera is pointing east, towards the best view that he has - avoiding the downs to the south of Steyning and trees in other directions. Therefore Nick is able to detect meteors entering the atmosphere across Kent, East Sussex, the English Channel, parts of northern France and Belgium. The software is set up to activate 45 minutes after sunset and deactivate 45 minutes before sunrise.

Alongside the UFO Capture software, which costs about £135, Nick uses UFO Analyser and UFO Orbit, both of which are free. UFO Analyser works through videos and can tally how many meteors it has recorded in the year. It identifies where stars are and can concentrate on the captured meteors and can plot them against the background stars, and so it can track where it entered our atmosphere, working out at what altitude it became visible and at what altitude it burned out.

The next stage is to use UFO Orbit to work the orbit of the meteor when it was still in space and therefore you can determine whether a meteor came from a comet or an asteroid.

Recorded meteors from more than one site can be coordinated to determine the atmospheric trajectory, the velocity and the shower it came from, and if it was a sporadic that can also be worked out.

There are various meteor observing networks, UKMON (a monitoring website), NEMETODE (**Ne**twork for **Me**teor **T**riangulation and **O**rbit **De**termination), of which Nick is a member, and an international one called EDMOND (**E**uropean Vi**d**eo **M**ete**o**r **N**etwork **D**atabase). Nick's observations from Steyning are coordinated with others from the South Downs Planetarium in Chichester, Nick James in Chelmsford, David Dunn in Livarot in northern France and Clanfield in Hampshire. Their cameras may point in different directions, but between them they provide good coverage of meteors over south-eastern England, north-east France, Belgium and the sea between them. Together they record meteors whose trajectories and velocities can be calculated and their radiants determined.

Observations show that Geminids are slower than Perseids. Generally, Perseids are detected at an altitude of 110 km. Brighter meteors burn up at lower altitudes than fainter ones. Geminids are often detected at lower altitudes. There are more bright Perseids than Geminids, but the Geminid shower is richer at less bright magnitudes than the Perseid shower. Faster meteors tend to occur at higher altitudes than slower ones.

One notable event in the UK occurred on St Patrick's day in 2016 and Nick showed various videos of it, including one from Church Crookham, and its magnitude was estimated at -14.7. The trajectory took it over the area of Dorset and so Nick's camera, pointing away from it, did not pick it up, but it did pick up the sudden increase in brightness of the sky that occurred at that moment.

Sprites, which are electrical discharges above thunderstorms, are sometimes picked up by cameras set up to capture meteors.

Amateurs such as ourselves can also become meteor detectors and join NEMETODE or one of the other networks. A Watec camera can cost about £250, a fast lens between £50 and £150. UFO Capture costs about £135, the price not having changed for some time, and a suitable PC may cost between £150 and £300. These prices, while not small are also not massive and are well within the range of what many amateurs can afford.

Other things amateurs can do are spectroscopy, by purchasing a grating to enable analysis of the spectra of meteors, and this is particularly useful for determining whether a particular meteor has a cometary or asteroidal origin. Another area of study is radio observation of meteors, but that is a wide enough subject to constitute another talk, which we can look forward to on another day. This talk had been an excellent one and those present thanked Nick in the usual way.

Forthcoming meetings

April 17th 2019 Dr Dirk Froebrich – Hunting Outbursting Young Stars – a project that WAS members can participate in

May 15th 2019 Dr Chris Pearson – "A Decade to the Day of the Launch of the Herschel Observatory"

June 19th 2019 Steve Scott (Mission Director of Gee- Archaeological Survey) – "Pyramids, Temples and Sun Worship in Ancient Egypt"

July 17th 2019 William Joyce F.R.A.S. -"Astrobiology" (moved from March 20th. David Pulley of the Local Group (Bexhill) on the subject of "How do we Know they are all Planets?" will now be on April 15th, 2020.)