



From the President



I expect that, like me, many members grew up through the years of the Space Race and will have fond memories of the *Apollo 11* Moon

landing, the anniversary of which was the subject of much celebration in July. The *Apollo* programme was certainly one of the things that inspired my interest in space and astronomy. 50 years on, we have seen huge advances in technology, but the world around us is not that which we anticipated all those years ago. Maybe flying cars were just a pipe dream, but I think we would all have expected there to be permanent, manned Moon bases by now, and steps to have been taken on the way to manned exploration of Mars.

The Space Race was certainly a major inspiration to the youth of the day to pursue careers in science and technology, but sadly there are few such programmes to inspire our next generation of scientists and engineers. It is difficult to describe the excitement of the *Apollo* era to those who have not lived through it, but it was certainly a watershed moment for the human race – a ‘giant leap for mankind’.

A successful Star Count

I only recently caught up on the results of the ‘Star Count’ project that we ran with the Campaign to Protect Rural England (CPRE). This was amazingly successful, with more than 2,000 observations reported: about three times the number submitted in the previous run (though maybe the weather played a part here).

While the results are not rigorously scientific (there are some notable outliers), they give an idea of how the night sky has been experienced. The project also encouraged people – including families – to go out, look at the night sky and take part in a science experiment. If it gives even just a few of those an interest in astronomy, then that will have been a good thing.

You can view an interactive map of the survey results on the CPRE website at: <http://www.cpre.org.uk/starcounmap>.

Changes to our Constitution

At our May Special General Meeting, the proposed changes to our Articles of Association and By-Laws were approved by members. These come into effect in the new session of the Association, which starts after the AGM in October. A new booklet will be produced and also made available to download on the BAA website. It is not intended to send the new booklet to all members as this would cost quite a lot, but anyone who requires an updated booklet will be able to request one.

Elections

Accompanying this *Journal* are voting slips and candidate notes for the upcoming election



The results of the 2019 Star Count, mapped. Red dots indicate locations where participants could see fewer than seven stars within the main asterism of Orion.

of the Board of Trustees and Council of the Association.

Last year we introduced electronic voting to enable our digital subscribers to vote, and the facility was well used by both digital and ‘traditional’ members. The total votes cast more than doubled and I hope that this year many more will take advantage of this quick and easy way to vote – it saves you the price of a stamp too!

We have an excellent set of candidates put forward for election this year, so I think it is important that members show their support by voting.

Summer Meeting

We returned to the Rutherford Appleton Laboratory (RAL) near Didcot for our Summer Meeting this year. It was an excellent day out, with a terrific line-up of speakers. Many thanks go to Newbury Astronomical Society for the local organisation (led by Ann Davies and David Boyd), RAL and the Science & Technology Facilities Council (STFC) for supporting the meeting, and to all the presenters.

Our Summer Meetings really seem to be taking off, so I hope you will be able to come to one of these as we move them round the country. The 2020 event is planned for Elgin, Moray, in the north of Scotland.

Meetings at the Institute of Physics

When our new Meetings Card is issued for the 2019/2020 session, you will notice that our London meetings will be hosted at the Institute of Physics (IoP) headquarters in Kings Cross. This is a fantastic new venue for our meetings, which provides a larger lecture theatre and other excellent facilities. It is not clear whether we will be able to live-stream all the meetings from the IoP, but we do hope to stream the Christmas and other major meetings there.

We are very grateful to the IoP for supporting the BAA, and we look forward to a long and mutually fruitful relationship.

Callum Potter, *President*

Networks reach major milestone for video meteor capture over British Isles



Steve Bosley, *Vice Chairman, Hampshire Astronomical Group at Clanfield Observatory*

In mid-2012, two meteor detection networks were being set up independently in the north and south of the UK. Those two networks were NEMETODE (NETwork for METeor Triangulation & Orbit DETERmination, co-founded by William Stewart and Alex Pratt) and UKMON (United Kingdom Meteor Observation Network, co-founded by Richard Kacerek and Peter Campbell Burns), and they have grown significantly in the nearly seven years since.

The earliest observations in the database were made by William from Ravensmoor, Cheshire in 2010 October. Subsequently, the first match recorded was between two NEMETODE cameras on 2012 Apr 14 at 22:30:20, between William’s camera and Alex’s camera at Leeds, Yorkshire.

The first inter-network observation was of a Perseid on 2012 Aug 9 at 21:49:02 UTC, although the match wasn’t recognised at the time (Figure 1). It was made by Alex’s NEMETODE camera in Leeds, and Peter’s UKMON camera in Church Crookham, Hampshire.

Wind the clock forward to 2019 April and together, the two networks have just posted their 500,000th observation. Observers come from the length and breadth of the British Isles and indeed there are several in Eire and Northern France – all have contributed significantly to the haul, and we should celebrate this achievement. Also, I should admit that my scripts had missed a couple of sets of early data and so it is fair to say that by the end of April we had smashed the record with a whopping 545,737 observations!

There have been meteors from radiants across all the northern skies and over all but the extremities of the British Isles, as can be seen from the ground map in Figure 2.

Individual stations have come and gone; cameras have been added, moved, removed, and/or upgraded. Yet the two networks are now delivering almost complete coverage of the UK skies, maximising the number of captures achieved. In fact, there have been contributions from at least 123 individual camera installations. This data is used by amateurs such as myself to analyse the orbits of the parent meteoroids but, more significantly, it is shared with the Europe-wide network, EDMONd (European viDeo Meteor) ▶



► Observation Network), to enable a much less weather-dependent analysis. It can be frustrating when strong shower activity is anticipated, but the whole of the UK is clouded out.

At Clanfield, we were an early participant in the UKMON network – indeed, we made the first UKMON pairing between our North camera and Peter’s Church Crookham camera on 2012 Sep 5 at 01:35:44 UTC.

Very early on I realised the opportunity afforded by membership of both networks. Whilst they began with a distinct north/south focus, as they grew the overlap quickly became more and more significant.

There were early concerns that we would be mixing higher and lower definition captures which might affect the quality of combined results, but I wasn’t so sure and so Hampshire Astronomical Group (HAG) decided to buy a Watec camera and join NEMETODE too. The original UKMON cameras were selected to be affordable and used cameras with 1/3-inch chips, whereas the NEMETODE Watec cameras were significantly more expensive but used 1/2-inch chips, so offering better resolution (eBay has since reduced that price differential).

In the worst case scenario we would share Watec data with NEMETODE only, and the data from the other two cameras with UKMON only. However, from day one we have shared data from all cameras with both networks, to the benefit of both.

Having access to the data from both networks has meant that we have had to respect the ownership of the data mined from each network, and over the years I have developed scripts to enable me to analyse each network’s data separately. However, bringing the data together into a single UK-wide dataset allows me to take advantage of the very significant overlap that the two networks

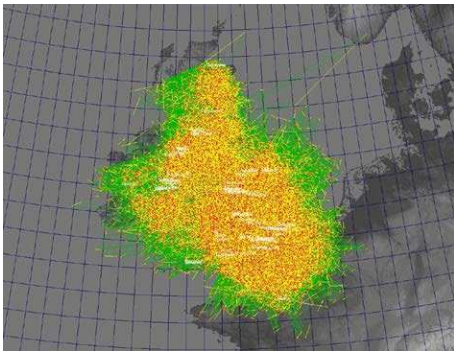


Figure 2. Ground map of consolidated data from the NEMETODE & UKMON networks. Figures 2 & 3 by Steve Bosley, using Sonotaco UFO Orbit.

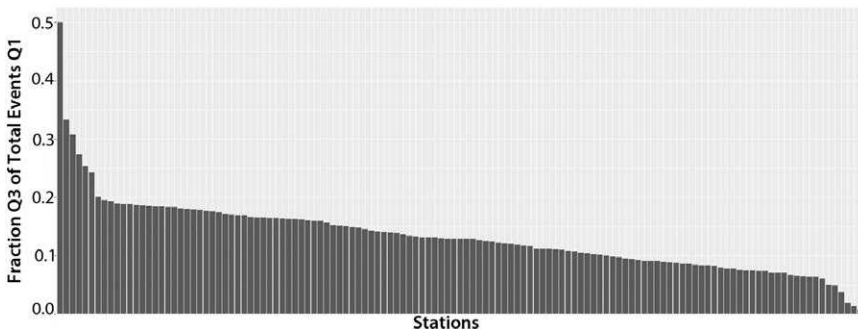


Figure 3. Data quality, with each bar corresponding to a camera on the networks.



Figure 1. A Perseid captured on 2012 Aug 9 by the NEMETODE and UKMON cameras of Alex Pratt (left) and Peter Campbell Burns (right), respectively.

now enjoy. The science behind the capture of these videos is down to statistics, and the quality of the analysis is directly proportional to the number of observations of each and every event. More and more observers are joining both networks and I can only see this trend increasing.

How does the quality of the datasets compare? Qualitatively, there is no difference. When I chart the count of observations which meet the most stringent quality threshold (Q3 in the Sonotaco UFO Orbit software parlance), it is impossible to spot which data are captured by NEMETODE stations and which by UKMON stations (the Q3 counts are normalised by considering their ratio to the total observations (at Q1) for each camera). In truth, this chart (Figure 3) hides the fact that some cameras may be preferentially aligned with others and so it would be interesting to repeat the analysis for all pairs of stations. However, it is clear that there is no technology divide, so I am happy that all UK observations are equally valid.

Over the seven years, every so often we have captured some pretty spectacular fireballs – the highlight having to be the St Patrick’s Day fireball of 2016 (Figure 4). This made the national press and because it was recorded by several captures, we were able to get some detailed analysis done by our friend Jakub Koukal of EDMOND, who determined its mass (50±16kg) and orbit (stretching beyond Jupiter, so no residual meteorite expected).

Before closing, it should be recognised that these were not the first attempts. There were other ‘early pioneers’ active across the British Isles from the 1970s, and in the 1990s Andrew Elliott pioneered amateur video meteor triangulation with Steve Evans, Tim Haymes *et al.* In the late 1990s Alex ran a camera matching with Len Entwisle. There are also other ongoing collaborations between Robert Cobain and Armagh

Observatory, which pre-date UKMON & NEMETODE by some years.

We certainly won’t have to wait seven years before we can celebrate the one millionth meteor video observation over the British Isles. News of the science that can be extracted from such simple capture systems is spreading. New members are joining each network all the time, including some significant players such as the Natural History Museum and at least one secondary school (this is a great tool for promoting STEM subjects). The technology is changing too – several keen ‘techies’ are experimenting with more sensitive cameras and Raspberry Pi systems to see if they have the resilience of the proven systems in operation today.

I am not a huge fan of social media, but I can’t help being impressed by the way that UKMON engage the public on Twitter and with their live feed from cameras. Scientifically, I think we still have some way to go – dark flight calculations are complex and there haven’t been any killer papers published yet. However, the dozen or so that have been published, by both networks, have set the bar.

With other professional and amateur groups (such as Jim Rowe’s SCAMP network) deploying all-sky cameras, the game is on to identify a fireball that survives the Earth’s atmosphere so that a meteorite can be recovered for analysis (hence the interest of the Natural History Museum, amongst others).

Will a meteorite fall be retrieved in the UK before we get to one million observations? Almost certainly! 🍀

Links

NEMETODE: www.nemetode.org

UKMON: www.ukmeteornetwork.co.uk

Hampshire Astronomical Group: www.hantsastro.org.uk

SCAMP (System for Capture of Asteroid & Meteorite Paths): www.scamp.org.uk



Figure 4. The St Patrick’s Day fireball of 2016, captured by the Hampshire Astronomical Group camera at 03:16:54 UT on 2017 Mar 17. HAG