Is it worth losing sleep over?

by Peter Birtwhistle

The 2012 George Alcock Memorial Lecture, given on 2012 May 30 at Burlington House, Piccadilly, London, W1

George Alcock's many comet and novae discoveries are well known and inspiring achievements, unlikely to ever be surpassed. However, the theme of my talk *Is it worth losing sleep over?* is not to try to make people yearn for the days before electronic cameras and space telescopes, when an amateur astronomer could go out with a pair of binoculars and pick up visual discovery after visual discovery. Rather, it is to show that even though George possessed exceptional observational skills and had an incredible capacity for learning star patterns, he also put in the time at every opportunity to be out there observing.

No better example was his last comet discovery, Comet IRAS–Araki–Alcock in 1983, when he picked up the large and bright comet using binoculars, sweeping the sky through a window in his house. The comet was big and bright enough for anyone to discover, but George was looking and that was the difference. The times of his discoveries were scattered throughout the night from dusk till dawn: if the sky was clear he would be there.

A similar dedication was shown by another great British observer and past BAA President, Dr Reggie Waterfield. I was fortunate to have been able to visit Reggie at his Woolston Observatory in Somerset on a number of occasions during the late 1970s. Reggie was in a wheelchair for most of his adult life, but did not let that get in the way of his single-minded desire to observe; he would invite people down to help him, but his drive and determination were inspirational.

Woolston was the main source of astrometric cometary positions from Great Britain for decades, at a time when everything about astrometry was hard, from guiding the telescope by hand with slow motions operated by ropes, taking photographs on glass plates, measuring with a small mechanical measuring machine and working out astrometric positions on a hand-cranked adding machine. This and other experiences led me to take up asteroid and cometary astrometry in later years, a very much easier task with today's CCD cameras, go-to telescopes and computers than it was during the decades that Reggie operated the Woolston Observatory.

These days the Minor Planet Center in Boston, Massachusetts handles all the minor planet and comet positional data measured by professional and amateur observatories around the world, and provides details of new and interesting comet and asteroid discoveries via a webpage called the Near-Earth Object Confirmation Page or NEOCP. This is a rich source of information for observers to tap into and is routinely used by amateurs to help keep track of the ever-increasing population of known Near-Earth Asteroids, and any newly discovered objects with unusual orbits that are deemed to be 'interesting'.

So as well as new Near-Earth Asteroids, other objects such as Mars crossing asteroids, Jupiter Trojans or Trans-Neptunian Objects might be listed. Sometimes NEOCP objects turn out to be main belt asteroids that might have looked interesting from the first few reported positions, but end up being routine when more observations are received.

As an amateur picking objects off the page to observe, you are never quite sure what you might get. Comets are frequent but unannounced visitors on the page. In the ten years that I have been using the NEOCP, there have been 74 occasions where a NEOCP object has been observed, expected to be an asteroid but turning out to be a comet. Some of these have been glaringly obvious, with bright tails and coma. Others have been very difficult to tell, with just the slightest hint of fuzziness and needing careful measurement to confirm their cometary nature.

Another category of object appearing on the NEOCP is objects that don't do what they are supposed to do. One of these was a new discovery by the NEO search programme LINEAR in 2010 January. Instead of being asteroidal it appeared in the discovery confirmation images as a streak. It looked like a comet except that it had no head, which caused quite a problem trying to measure its position; there was no centre of light to set the crosshairs on. The appearance was very unusual and caused a lot of interest from amateurs and professionals in the following days and weeks. With deep images from large ground-based telescopes and the Hubble Space Telescope the appearance was found to have been caused by a very faint, 24th magnitude asteroid being struck by an even smaller asteroid, causing a large and complex

Top of page: Image of newly-discovered comet C/2012 S1 (ISON), taken by Nick James with an unfiltered C11 280mm SCT at a mid-time of 04:06:24 on 2012 October 15. 32×60s exposure, STXE9 CCD. *Nick D. James.*

dust cloud to be kicked into space and forming the streak.

This was the first confirmed case of such an asteroidal collision, but a second was reported via the NEOCP in December of the same year. This time a 13th magnitude large main belt asteroid (596) Scheila, that had been observed for 100 years, was found to be surrounded by what looked like coma but again was caused by an asteroidal impact, and like P/2010 A2 (LINEAR) the coma dissipated in the following weeks and months. We are lucky to be living in interesting times – there is now so much attention being paid to the sky that unusual events such as these that might have gone unnoticed in the past are now being routinely picked up.

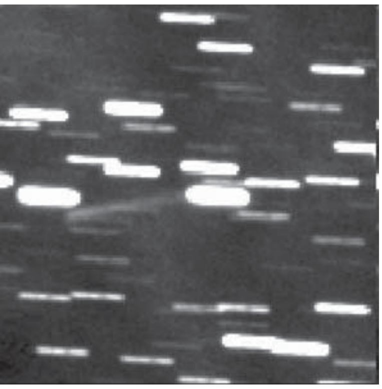

Image by the author of Comet P/2010 A2 (LINEAR) 17 hours after discovery, appearing as a headless fuzzy streak among the star trails.

Although unusual objects like these do get put on the NEOCP, the main bulk of objects are Near Earth Asteroids, and amateurs can make useful contributions by helping to follow up newly discovered objects, allowing their orbits to be improved. There are many examples where the early recovery by an amateur of a recently discovered and fast moving NEO can make the difference between an object having a reliable orbit determined or being hopelessly lost.

One example of such a NEO was 2005 NG56, where two days after discovery the uncertainty area was calculated to be an 8° long band, increasing in size by the hour. With a field of view just 1/3 degree across, multiple images in 21 different fields were taken searching for the object before eventually locating it. After a long search such as this, it can be very rewarding finally locating the object.

A more recent example from earlier this year, 2012 FP35, was a newly discovered and unconfirmed fast moving asteroid. The area it was expected to be in was searched but with no success. After widening the search it was eventually found and although the original prediction had it moving at 8 arcseconds per minute, in reality it was travelling nearly 40% faster, enough for it to almost be lost. By the next night it was moving 100 times faster at nearly 1/3 of a degree per minute and had approached to less than half the distance of the Moon from the Earth. If not recovered on that first night this one stood no chance of being found again.

Comet 73P/Schwassmann-Wachmann 3 on 2006 May 6, leaving behind a shower of disintegrating fragments. *P. Birtwhistle*.

Comet 73P/Schwassmann-Wachmann 3 provides another interesting example of what can happen. Discovered in 1930 during a close approach to within 0.06 AU of Earth when it reached magnitude +6, it was then lost until 1979 and was missed again in 1985/86. The 1995 return was not particularly favourable, but a 5 to 7 magnitude outburst was observed in 1995 September. By 1995 December, observers were reporting multiple nuclei within the coma. 2001 was again unfavourable but the comet was brighter than expected and two of the components from 1995 were re-observed. The 2006 apparition was very favourable with a close approach to 0.07 AU predicted for 2006 May 13.

A mosaic of Spitzer Space Telescope images taken in 2006 May in the infrared showed the two main components C & B joined by an almost continuous thin band of light with dozens of fainter fragments strung out along the line. From one night to the next these fragments would brighten up or fade away and over the weeks leading up the close approach, taking images along this line revealed interesting details of this cometary break-up.

I managed to get a deep image of component B on May 6, showing the central region and a large coma. However, some days later an image taken on May 1 with a 1.8m telescope was published showing component B with a shower of debris coming from it. Then another picture, this time taken with a 1.2m telescope on May 5 again showed a trail of fragments being left behind.

Re-examining my image from May 6 and with some unsharp-mask processing to enhance contrast, the string of fragments was also rendered visible, taken with a mere 0.4m telescope, and remarkably similar in appearance to the view from the larger instrument the day before.

It is not always obvious at the time what interesting things you might come across in the sky, but you have to be out there observing to stand a chance, so...

Yes, it is worth losing sleep over!

Peter Birtwhistle