

Two challenging galaxies in Leo

By midnight in February the prominent winter constellations are starting to slip into the west, to be replaced by those of spring. And while Orion dominated the December and January skies it is Leo who takes centre stage as the months move on. Its distinctive shape makes it one of the most conspicuous of the constellations, although whether it looks particularly like a lion is open to debate. Leo is home to numerous galaxies, with something to suit everyone, from the spectacular NGC 2903 that Messier and his colleagues could have discovered (see *Observers' Forum* **120**(2), 2010) to the distant galaxy cluster Abell 1367. Two galaxies that are challenging for both the visual observer and the imager are Leo I and Leo II. These dwarf spheroidal galaxies, which are members of the Local Group, were only discovered in 1950 by US astronomers Robert Harrington and Albert Wilson examining the Palomar Observatory Sky Survey (POSS) plates. Interestingly, 60 years on discoveries are still being made on these plates showing what a valuable resource they remain.

Dwarf spheroidal galaxies are similar in many respects to elliptical galaxies. They show little evidence of nebulosity or recent star formation and contain few heavy elements. In fact deep images of these two Leo galaxies make them look remarkably like low-density resolved globular clusters. However, due to their closeness it has been possible to examine them in detail, and the range of stellar populations is greater than in a globular, showing evidence of star formation over an extended period, although none in recent times. In 2007 the 8.2m Subaru telescope on Mauna Kea, Hawaii observed Leo II and detected over 80,000 stars down to a visible magnitude of 26. The mass to light ratio in these galaxies is also larger than in a globular cluster, suggesting a large dark matter component.

Of the two galaxies, Leo I (UGC 5470) is the easier to locate, in fact it is probably the easiest galaxy in the entire sky to locate as it lies just 20 arcmin north of mag 1.4 Regulus (alpha Leonis) at RA 10h 08.5min and Dec +12° 18.5' (2000.0). Seeing the galaxy however is entirely another matter. At a distance of just 900,000 light years it presents a size on the sky of 9.8×7.4 arcmin and although it has a visual magnitude of 9.8 the large size means that its surface brightness is extremely low. This, coupled with the proximity to Regulus, makes it a very challenging visual target.

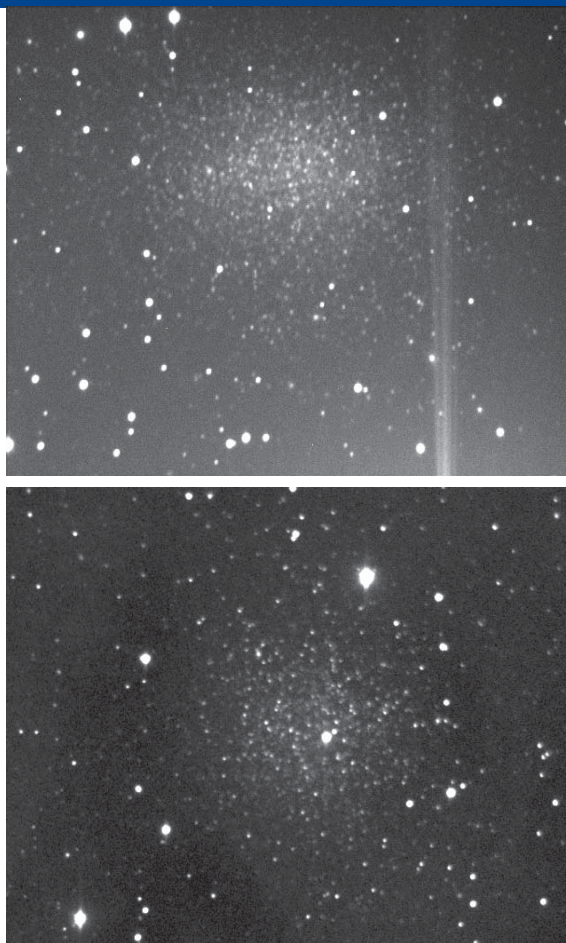
Choice of magnification is important as it is essential to put Regulus out of the field of view while at the same time having a large enough field so that there is dark sky around the galaxy. Do not expect to see any

individual stars – the best that can be hoped for is a slight change in the background glow as the galaxy moves through the field. All the tricks of deep sky observing at the limit will be necessary, such as full dark adaptation, averted vision and a pristine dark sky site, along with a telescope in the half-metre class. Even in a 64cm (25-inch) Dobsonian from high altitude in Tenerife the Director and Owen Brazell found Leo I only appeared as a circular patch of haze, very slightly brighter than the background sky.

Due to the proximity of Regulus Leo I is also a tricky photographic target and the only image in the Section archives was obtained by Grant Privett using a 10-inch (25cm) f/4.4 Newtonian under poor seeing and conditions of heavy dew in 2007 February. The resulting composite image shown here consists of 80×30s individual frames stacked and processed in batches of 20. The bright flare is from Regulus, accentuated in this case by the poor atmospheric conditions. An excellent David Malin image from the Australian Astronomical Observatory (AAO), along with accompanying text, is available at <http://www.aao.gov.au/images/captions/aat051.html>. A Russell Croman image of Leo I also featured as *Astronomy Picture of the Day* on 2006 June 19. This is a fascinating image as it shows both Regulus and the galaxy in the same field of view.

Leo II (UGC 6253) is slightly closer to us than Leo I at around 760,000 light years. It is located at the rear of Leo and lies 1.6° almost due north of Zosma (delta Leonis) at RA 11h 13.5m and Dec +22° 09.2'. With a magnitude of 11.9 and a size of 10.1×9.0 arcmin it is a more challenging target than Leo I and I am not aware of any visual observations from the UK. US astronomer Phillip Harrington describes his observation of it in his book *Cosmic Challenges* (Cambridge University Press, 2011). Grant Privett has also photographed this galaxy from his home in Fovant, Wiltshire and his image (20×4min sub images) using the same equipment as for Leo I is shown here.

The 2007 image from the Japanese Subaru



Leo I (top) and Leo II by Grant Privett. (See text for details.)

is available online at http://www.naoj.org/Pressrelease/2007/11/28/fig01_h.jpg. It is interesting to compare this Subaru image with Grant's – one from an 8.2m telescope on the summit of Mauna Kea and the other from a 0.25m telescope in a back garden in Wiltshire.

Stewart L. Moore, Director, Deep Sky Section

Erratum – Comet 103P/Hartley

Jonathan Shanklin has pointed out that the superb image from NASA's *EPOXI* mission reproduced on page 339 of the December *Journal* was mislabelled, following NASA's lead, as 'Comet Hartley 2'. This nomenclature is obsolete, and the correct IAU naming style is 'Comet 103P/Hartley'.

As Jonathan rightly says, 'NASA are wrong, and we should not propagate their mistakes'. Apologies. *Ed.*



Total eclipse of the Moon, 2010 December 21



Images of the December 21 eclipse. Above: Damian Peach, Selsey, UK. Right, top: Maurice Collins, New Zealand. Right, below: Rik Hill, USA.

The national press made a great deal of this eclipse, largely because it coincided with the winter solstice and totality took place at moonset for observers in the UK. Both of these are relatively rare occurrences, but the December 21 eclipse turned out to be routine in most other respects.

Few reports were received from UK observers, most of whom were defeated either by bad weather or by the Moon's low altitude. However, Damian Peach was able to photograph the partial phase from Selsey, but he had to finish observing at 07:15 UT, when the Moon was about 60% eclipsed. He reported that the eclipse did not appear to be particularly dark, and that with the use of binoculars surface features remained clearly visible within the shadow. This was the case also for Maurice Collins in New Zealand, where the eclipse occurred at moonrise. He reported a distinctly orange cast to the eclipsed Moon.

For Rik Hill, however, observing from the USA (where the eclipse was visible in its entirety), the eclipse was the darkest he had seen since 1963.

Although the Icelandic volcanic activity in 2010 might have led us to expect a dark eclipse, the paucity of observations received does not allow any firm conclusions about just how dark or light this event actually was.

Bill Leatherbarrow, *Director, Lunar Section*



Join the CfDS and CPRE in Orion Star Count Week

In 2007 the Campaign to Protect Rural England (CPRE) and the BAA Campaign for Dark Skies (CfDS) asked people across the country to count the stars they could see in the Orion rectangle, in order to measure the extent of light pollution. In that year, only 2% of respondents said they could see more than 30 stars in Orion, compared with 54% who saw fewer than 10 – a level which indicates severe light pollution. The results from the 2011 count will enable researchers to see whether light pollution is continuing to get worse or if there has been an improvement.



Campaign to Protect Rural England

Emma Marrington, Rural Policy Campaigner at CPRE, says: 'The Star Count survey will help us measure the extent of light pollution. We want to use this evidence to convince Ministers and local councils of the need to take action to tackle it, for example by ensuring that the correct lighting is used only where it is needed and when it is needed. This would cut light pollution, reduce carbon emissions and save money at the same time. Some local authorities are already taking action to tackle light pollution in their areas; we need more to do the same.'

This year's Star Count Week is between Monday January 31 and Sunday February 5. Participants can choose any night between these dates (inclusive) but the sky must be clear, with no haze or clouds, and it is recommended that observations are made after 7 p.m. so the sky is sufficiently dark. Observers (and their families and friends) should find a dark spot shielded from local lights, and using only the unaided eye (not binoculars or telescopes), should count the number of stars they can see inside the rectangle bounded by Betelgeuse, Rigel, γ and κ Orionis. Do not count these four bright stars, but do include the three stars of Orion's belt in your count.

Log on to www.cpre.org.uk/starcount and complete the online survey form, or send your count with the date and time it was made and the location, to: **Star Count, Campaign for Dark Skies, 38 The Vineries, Colehill, Wimborne, Dorset BH21 2PX.**





The UK daylight fireball of 2009 December 19

This report describes actions and results in relation to this event and the appeal for observations issued in an e-circular sent out by the BAA Meteor Section. Information has been accumulated via contacts from BAA members, members of the public and from various information and news sources available in the public domain. In addition early contact was made with the author of this report by David Entwistle, Assistant Director of the Meteor Section of the Society for Popular Astronomy (SPA), regarding 'pooling' of information collected.

This is the text of the e-circular issued by the BAA Meteor Section:

'Daylight fireball on 19 December 2009

Reports are coming in of a daylight fireball, visible between about 12:40 and 12:45 pm on Saturday, 19th December 2009. Sightings have so far been received from observers in South Yorkshire, Lincolnshire and Norfolk, but it is likely that the event would have been visible across most of the East Midlands and Eastern England.

Such sightings are rare since few fireballs are bright enough to be visible in broad daylight, although the Sun is rather low in the sky at local noon at this time of the year. Many areas of the country enjoyed clear blue cloudless skies early on the Saturday afternoon in question.

Any BAA members who saw this event, or who may have been contacted by non-astronomers who witnessed it, are asked to collect as much information about the sighting as possible and send it to the BAA Meteor Section's Fireball Co-ordinator Len Entwistle at <len.entwisle@btopenworld.com>.

Useful information will include the precise time of the event, the altitude and azimuth of the start and end points of the vis-

ible track, the position of the observed track relative to the Sun in the sky (if seen towards the south), and a description of the fireball's appearance together with any unusual features.

Dr John W. Mason
Acting Director, BAA
Meteor Section.'

Actions

Reports were received via e-mail from the observer(s) directly to the author (LE) as well as further e-mail information received and made available from David Entwistle (SPA). Further e-mail contact was made with some observers to hopefully clarify some points. As there were two Entwistles/Entwistles (!!) involved in the investigation of the same event, representing two different organisations, we had to be careful not to cause confusion.

All of the e-mail-derived information from the naked eye reports was summarised in a single document and the locations from where the event was observed were marked on Google Maps. The observers were scattered across the counties of South Yorkshire, Lincolnshire, Nottinghamshire, Norfolk, Cambridgeshire and Leicestershire (see table).

In addition to the visual accounts, LE identified that there were two video-based all-sky cameras in the area of the event observations. These were the BeskeenCam at Bourne in Cambridgeshire run by Paul Beskeen (<http://www.beskeen.com/allskycam.shtml>) and Paul Pugh's unit at <http://www.paul-pugh.net/live/video.html> in Derbyshire.

Checks showed that the BeskeenCam was in operation at the time of the visual observations of the event.

On the basis of the information provided by LE, David Entwistle (SPA) made contact with Paul Beskeen. Videos from the all sky camera at the time of the event were supplied, and Paul commented: 'Luckily the target time is close to the start of the video. Normally events

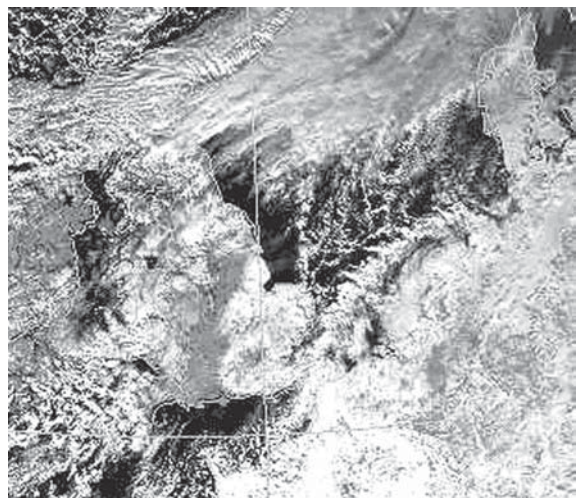


Figure 1. Satellite image of cloud cover over the UK at 13:12 UT on 2009 Dec 19. NEODASS-Plymouth.

of this nature do not show up unless we get lucky – as we only record one frame per minute. In this case, however, I see an orphan contrail that becomes visible at 12:46 that is possibly related to the event. As it's right on the horizon its start time is very indistinct, but it could easily be there a minute earlier. See the following individual frames [frame references given].

The orientation of the camera frame is N top, S bottom, W right, E left So the contrail appears in the SW quadrant and is orientated SW-NE. Norwich is roughly NE from our site The timing and orientation suggest that it is connected, but of course it will probably remain in the realm of circumstantial evidence – contrails appear in the sky all the time. Let us know what you think, and feel free to pass on the info, as you see fit. Must have been quite a sight!

LE inspected the relevant video frames and did not think they added anything significant to the information already received, but they were worth checking out. LE subsequently identified a third video all-sky unit at the Institute of Astronomy, Cambridge with archived video at <http://tel05.ast.cam.ac.uk/> This latter unit does not run 24/7 but is worth keeping an eye on in the future for similar bright objects when they occur.

Due to the fireball's brightness and the event's location on the UK eastern coastline, LE considered it worthwhile to check out sources in the Netherlands and Belgium and the Yahoo Vuurball group (Centraal meldpunt voor Vuurballen – Yahoo). Sadly, nothing was picked up in relation to this event, possibly due to cloud banks over the North Sea. Figure 1 shows the cloud cover at 13:12 UT on the day of the event. The

Observers of the 2009 Dec 19 fireball

(listed in alphabetical order)

David Clover	Billinghay, Lincs.
Jimmy Greenwood	Driving on A47 near Wisbech, Cambs.
Sarah Hart	Near Fenstanton, Cambs.
Emma Langrick	Scremby, Lincs.
Neil McCallum	Burnham Overy Town, Norfolk
Colin Mead + 2 others	Holton cum Beckering, Lincs.
Dianne Parker	On A52 nr Easthorpe/Muston, Notts.
John Pullen	Rotherham, S. Yorks.
Sue Russell	Wisbech St Mary, Cambs.
Nathalie Salles	On A14 nr Huntingdon, Cambs.
J. R. Samworth	On A512 nr Loughborough, Leics.
Mike Smith –Howell	On A17 nr Sutton Bridge, Lincs.
Garry Wade	On A16 nr Market Deeping, Lincs.
Vicky Welham	Bourne, Lincs.

Sun would be to the south and at low, winter, altitude.

In addition to the visual report e-mails and the video all sky checks, the following potential information sources were checked by LE over several days:

Cromer Coastguard Online Reports
 Humber Coastguard Reports
<http://www.uk-ufo.co.uk/>
 Yorkshire Post
<http://www.ely-standard.co.uk>
<http://www.greatyarmouthmercury.co.uk>
<http://www.wisbech-standard.co.uk>
<http://www.thisisgrimsby.co.uk/news>
<http://www.skegnessstandard.co.uk/news>
www.thisislincolnshire.co.uk/news
<http://www.louthleader.co.uk>
<http://www.gainsboroughstandard.co.uk/>
<http://www.newarkadvertiser.co.uk/newsindex>
<http://www.retfordtoday.co>
<http://www.worksopguardian.co.uk/news>
<http://www.thisisscunthorpe.co.uk/news>
www.stamfordmercury.co.uk/
<http://www.peterboroughtoday.co.uk/news/Meteor-Stargazers-in-a-spin.5934323.jp>
<http://fireballs-meteorites.blogspot.com/2009/12/december-2009.html>

<http://lunarmeteoritehunters.blogspot.com>

As most of the fireball reports received came from drivers of vehicles that were actually in motion, a search on Google was carried out with various driving visual parameters. Searches on 'attentional visual field (AVF)' and 'useful field of view' were used. The *Journal of the Royal Astronomical Society of Canada* was researched for papers on the visual accuracy of fireball observations. The hope was that some angular constraints for objects seen while driving might be inferred. Unfortunately, nothing useful was found.

On a future occasion the use of a 'wind-screen diagram' could be considered, on which the observer draws the line of the fireball path. In conjunction with Google Maps and the driver's literal description of what they see and where they are on their journey we might be able to extract slightly more information than was possible on this occasion.

The author (LE) has a preference for the use of an analogue clock face diagram for 'flight direction' rather than the compass rose, e.g. vertical downwards = 'from 12 o'clock to 6 o'clock', or another example, '2 o'clock to 8 o'clock', etc. During the author's laboratory career, he found this method of description quite useful when pointing things out to others. It has come in useful too in astronomy when pointing out

tiny sunspots on the solar disk.

The duration of the fireball was reported by ten observers with times between 1.5 seconds and 5 seconds giving a mean duration of 3.5 seconds.

None of the observers reported a long angular path. Two of the Lincolnshire observers (DC, EL) identified a right-to-left flight whereas all the others that provided this information (JP, GW, NS, NC, JRS and SH) identified a flight angle with a left-to-right flight, varying in its steepness dependent on the observer.

All the observations showed the fireball on an easterly azimuth probably placing it out over the North Sea and off the coast of Lincolnshire and Norfolk.

The majority of observers described the object as a bright white light or ball with two observers mentioning a possible small terminal flare [NC (Lincs), MSH (Lincs)].

Conclusion

On 2009 December 19 at close to 12:45 hrs UT a brilliant daylight fireball of a magnitude probably between -15 and -20 was recorded visually by observers viewing within the boundaries of South Yorkshire, Lincolnshire, Nottinghamshire, Norfolk, Cambridgeshire and Leicestershire.

The observations place the fireball over the North Sea off the coast of Lincolnshire and Norfolk. The consensus was that the object was brilliant white in appearance and was visible for about four seconds.

Len Entwisle, Fireball Coordinator, Meteor Section

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Deep Sky Section

Deep Sky Section Meeting 2011

In 2011 the Deep Sky Section is moving out of its Northampton comfort zone for its annual meeting, which this year will be hosted by Newbury Astronomical Society on Saturday March 12 at Ashford Hill Village Hall, Ashford Hill, near Thatcham, Berkshire, RG19 8BQ. Ashford Hill is approximately 4½ miles south-east of Newbury and 2½ miles south of the A4. There is plenty of free parking available at the venue.

As 2011 marks the 30th anniversary of the formation of the Section, the meeting will include some talks which take a look at how deep sky observing has changed during that time. The programme is still being finalised but speakers and topics confirmed so far include:

Stewart Moore: a review of the deep sky year
 David Arditti: using the f/2 Hyperstar system for deep sky imaging
 Owen Brazell: galaxy clusters for the amateur
 Nick Hewitt: Active Galactic Nebulae – why we should observe them
 Ron Arbour: then and now, a look back over 30 years of supernova hunting
 Geoffrey Johnstone: astrophotography in the 1980s, or why I didn't blow myself up
 Stewart Moore: images from the past – a look at the BAA deep sky archive

The professional talk will be given by Prof Derek Ward-Thompson from the School of Physics and Astronomy at Cardiff University, on the Herschel Space Telescope and star formation.

Doors open at 09:30 for coffee with talks starting at 10:00. The entrance fee of £10 (payable at the door) includes tea and coffee throughout the day along with a buffet lunch. It is hoped that the BAA, the Webb Deep Sky Society and Aurora Books will have sales stands at the meeting.

All BAA members and friends are very welcome.

Stewart Moore, Director

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