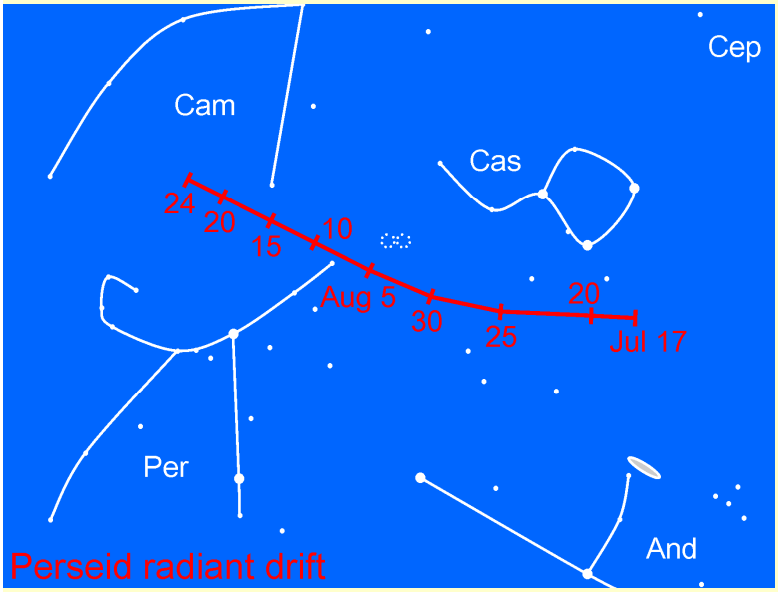
SPA Meteor Section Report

Perseids 2010

Introduction



The Perseid maximum in 2010 was expected between 18:30 UT on August 12 to 07:00 on August 13, most likely at some stage from about 23:30 to 02:00 UT, and was to benefit from new Moon on August 10. In early August, the International Astronomical Union announced a possibility that the Earth might encounter an outlying part of the dust trail laid down by the Perseids' parent comet, 109P/Swift-Tuttle, in 1479 AD, around 16:50 UT on August 12. Theoretical modelling indicated the stream would probably miss the Earth, so it was uncertain what, if any, effect this might have on Perseid rates. It was anticipated the usual peak would produce Zenithal Hourly Rates (ZHRs) of around 100.

Observers in Britain, as so often in recent summers, had mixed fortunes thanks to the weather, but the better sky conditions persisted for many places in southern England and Wales for several days across the Perseid maximum for once, while lucky watchers in a strip from Northern Ireland northeastwards over Scotland to the Dundee area on the east coast, were fortunate on August 12-13 especially. With excellent support from our overseas colleagues, and using the International Meteor Organization's (IMO's) preliminary results too, this report gives an overview of what the Perseids produced in 2010.

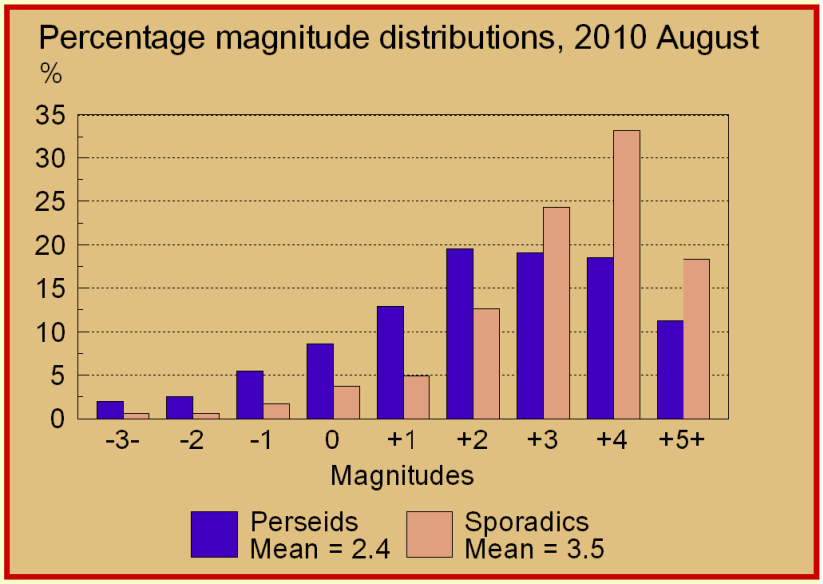
The Observers

The list of observers reporting to the Section was as follows, comprising quite casual viewers, through to dedicated meteors watchers, and including those who only gave pseudonyms or abbreviated names (primarily in online reports). Unmarked contributors, or those with "+ V", provided visual results, "R" means radio data were presented, and "I" imaging observations. Many of the British details were taken from the Perseid topics on the SPA's Observing and the UK Weather World's Space Weather Forums (see both for some meteor images too), with more kindly provided from the North American Meteor Network (NAMN) by its leader Mark Davis, and the German Arbeitskreis Meteore (AKM) group via its journal *Meteoros* **13:10** (2010), sent in by Ina Rendtel. Much of the radio data came via Radio Meteor Observation Bulletin (RMOB) 205 for August 2010, provided by Editor Chris Steyaert. To everyone below, very many thanks and a hearty "Well Done" for your efforts!

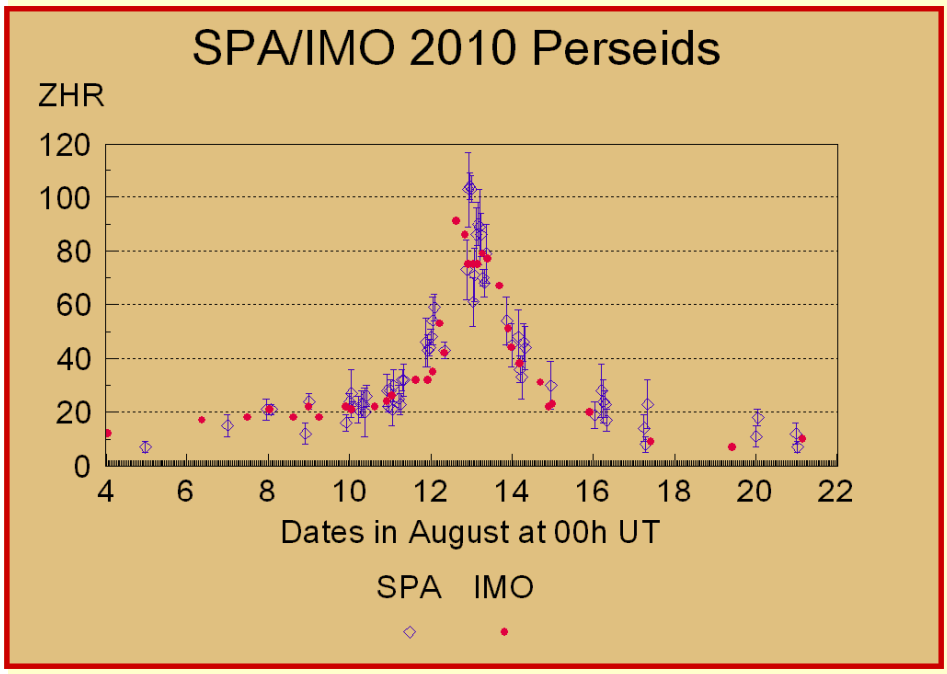
Michael Adams (England), Salvador Aguirre (Nevada, USA; NAMN), "akkan" (England), Enric Algeciras (Spain; RMOB; R), Sandy Allan (Scotland), Chris Alder (England), "andyT" (Wales), Karl Antier (France), Rainer Arlt (Germany; AKM), "@@" (England), Pierre Bader (Germany; AKM), Gordon Bain (England; I + V), Tom Banks (England), "billden" (England), Nigel Bolton (England), Michael Boschat (Nova Scotia, Canada; NAMN + RMOB; I, R + V), Pat Branch (Texas, USA; NAMN), Jeff Brower (British Columbia, Canada; RMOB; R), "Bushy" (England), Willy Camps (Belgium; RMOB; R), Michael Catlin (North Yorkshire; NAMN), "Charles" (England), "ChaserUK" (Channel Islands), "Cliff" (England; I + V), "coldfieldboundary" (Belgium), Johan Coussens (Belgium; RMOB; R), Tibor Csorgei (Slovakia; NAMN), Amanda Davies & husband (Wales), Mark Davis & daughter (South Carolina, USA; NAMN), Gaspard De Wilde (Belgium; RMOB; R), Paul Domaille (Channel Islands), Franky Dubois (Belgium; RMOB; R), Steve Dyer (England; I + V), David Entwistle (England; R), Lorraine Evans (England), Mike Feist (England), Kurt Fisher (Utah, USA; RMOB; R), Stela Frencheva (Germany; AKM), Karl-Heinz Gansel (Germany; RMOB; R), Christoph Gerber (Germany; AKM), George Gliba (West Virginia, USA; NAMN), Bill Godley (Oklahoma, USA; NAMN), "Godot" (England; I + V), Shelagh Godwin (England), Bill Haddon (California, USA), Dave Hancox (Scotland; I + V), Roberto Haver (Italy; NAMN; I + V), Alan Heath (England; R), Richard Hill (North Carolina, USA; NAMN), "HippyChippy" (England), Ken Hodonsky (Nebraska, USA; NAMN), "Jamie d" & fiancée (England), "Jane B" (England; I + V), "JohnF" (England), Gordon Johns (England; I + V), Sam Jowett (England), Ken Kennedy & Dundee AS members (Scotland), Richard Kramer & colleagues (Maine, USA; NAMN), "Lawrie" (location unstated), "Lightningfox92" (England), "louise79" (Northern Ireland), Hartwig Lüthen (Germany; AKM), Tony Markham (England), Pierre Martin (Ontario, Canada; NAMN; I + V), Paul Martsching (Iowa, USA; NAMN), Alastair McBeath (England), Tom McEwan (Scotland), Kenneth Meadows (England), Peter Meadows (England; I), "Miguella" (England), Jane Mills (England), Koen Miskotte (France; NAMN), Sirko Molau (Germany; AKM), "Naplesnut" (England), Sven Näther (Germany; AKM), David Oesper (Texas, USA; NAMN), Don Olson & colleagues (Texas, USA), Mike Otte (Illinois, USA; RMOB; R), Kenneth Pamment (England), "pettinger" (England), Jürgen Rendtel (Germany; AKM), Steve Roush (Arizona, USA; RMOB; R), Robin Scagell (England; I + V), Sergei Schmalz (Germany; AKM), Christian Schmiel (Germany; AKM), Stanislav Scholtz (Germany; AKM), "Scoggy" (England), Pete Scott (England; I + V), "scrapemedic" (England), Andy Smith (England; RMOB; R), Jason Smith (England), "snow hope" (Northern Ireland), Chris Stephen (Florida, USA; NAMN), R Stevenson (England), Chris Steyaert (Belgium; RMOB; R), Dave Swan (England; RMOB; R), Rich Taibi (Maryland & West Virginia, USA; NAMN), "tcmorris78" (Scotland), István Tepliczky (Hungary; NAMN), Harold Tinker (Ohio, USA), Peter Upton (England), "UtopiaPlanitia" (England), "Vadno581" & daughters (Scotland), Dirk Van Hessche (Belgium; RMOB; R), (Belgium; RMOB; R), Felix Verbelen (Belgium; RMOB; R), "vincentnm" (location unstated; I), Colin Watling (England), William Watson (Ontario, Canada, New York & Pennsylvania, USA; NAMN), "Winso" (England), "WSM-Weather" (England), Oliver Wusk (Germany; AKM).

Shower Review

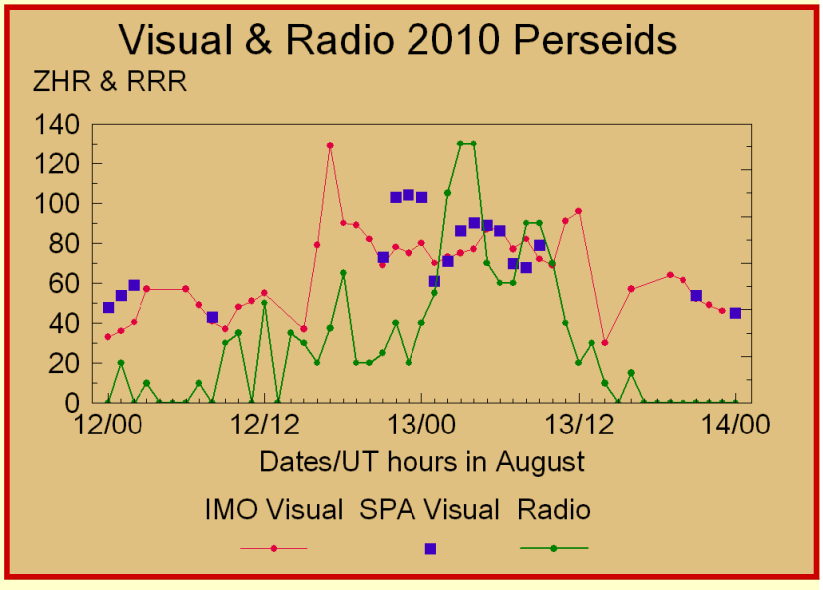
In total, 4717 Perseids and 1475 sporadics were reported to the Meteor Section from the first half of August. However, only a proportion of those were collected under suitable conditions, and reported in enough detail, to allow a full analysis. The magnitude distributions, illustrated below, were based on 1429 Perseids and 349 sporadics, for instance. The Perseid total allows a reasonable degree of confidence in the distribution, which appeared similar to normal, as did that for the sporadics, though with less confidence because of the smaller number of meteors involved. In both cases the mean magnitudes were those corrected to a limiting magnitude (LM) +6.5 sky.



Having established nothing untoward for the magnitudes, the Perseid ZHRs were then computed as usual, using data from skies where the LM was +5.5



or better, cloud cover was less than 20%, and where the radiant was above 25° elevation. The graph to the left here shows a comparison between the SPA ZHRs and those from the much larger IMO dataset (as given online on 2010 December 15). For clarity, no error bars are shown for the IMO data-points. In most cases, they were small enough to fall within the filled circles anyway. The graph to the lower right shows IMO and SPA visual results, with the radio findings, near the maximum, this time with no error bars at all, and with the datasets condensed to give single hourly values only. The SPA ZHRs suggested a peak of ~100 ± 10 around 22h-00h UT, apparently followed after a sharp dip by a second peak, with ZHRs of ~90 ± 10 from 03h-06h. The IMO results found a different pattern, seemingly with a broad plateau when ZHRs were ~70-90 from about 18h UT on August 12 till 10h on the 13th. This was flanked by two apparently stronger peaks, the first very sharply-defined, with ZHRs of ~130 ± 10 near 17:00-17:30 UT on August 12, the second between roughly 11h-12h UT on August 13, which produced ZHRs of about 100 ± 10. While both visual datasets fitted crudely to the broader-scale Perseid maximum prediction, and the first of the two stronger IMO peak timings was only a little after the possible encounter with Comet 109P/Swift-Tuttle's 1479 dust trail, the patterns found were rather different to normal for the shower. The Section's radio analysis suggested a different pattern again, judging by the Relative Radio Rate (RRR) comparison trace. The RRR is explained in more detail on the next page.



This RRR inferred the better Perseid activity happened between ~16h UT on August 12 to ~15h on August 13, with the main Perseid peak most apparent between 01h to 11h UT on August 13. There seemed to have been two phases within this interval, one around 02h-05h UT, the other from 08h-10h. There was evidence too for a possible early peak on August 12, between 17h-19h UT, especially ~18h-19h, but this potential event seemed weak as

contrasted with the main maximum activity on August 13. Examining the limited amount of longer-duration echo data (not illustrated here), implied this early peak may have been less rich in brighter meteors than the main one too, so neither the timing nor strength of the short-lived "early" IMO visual peak could be confirmed this way.

Around 38% of Perseids left persistent trains, much as usual, though too few trained sporadic details were provided to allow them to be analysed as well. Also as usual, numerous fireballs (meteors of magnitude -3 or brighter), mostly Perseids, were seen across the shower's maximum. One on August 12-13 at 21:43 ± 1m UT seemed to have been especially impressive, perhaps peaking between magnitudes -8 to -12. It was spotted from up to four locations in central-southern England, and while the details provided could not confirm all the witnesses had definitely seen the same meteor, assuming most probably did, it would likely have flown on a roughly northeast to southwest trajectory high above Northamptonshire-Warwickshire or points adjacent. Another spectacular object was spotted at 00:32 UT on August 12-13 by Karl Antier in Provence, southern France, despite clouds so thick he could barely see Jupiter at times. Luckily, one of his colleagues some distance away had better conditions and by-chance, managed to image this event.

The Relative Radio Rate

The method I have developed for radio meteor analyses over the past 15 years involves comparing the hourly radio meteor counts reported per system from day to day with one another during the interval a given shower's radiant could be observed for each radio receiver's location, allowing for the daily variation in sporadic rates and any identifiable interference. These individual results are then compared between systems, looking for confirmation and correlation of what each detected separately, and between the main geographic regions the observers were located, usually Europe and North America.

Along the way, simple numerical values are assigned to indicate when probable shower activity significantly different to normal was detected by a given observer's system. "Normal" here means periods when few or no shower meteors should have been present, as well as periods when shower meteors were detected at a lower level around the same time on nearby days. Zero indicates the normal state, and a positive number shows increased or otherwise unusual activity.

Combining this individual-system numerical information (sometimes with an element of weighting to allow for variable factors, such as a large number of active observers in one region but not another) allows a single total to be allocated to a particular time interval, based on what activity was detected, by how many different systems and where they were located. We can call this combined number the "Relative Radio Rate" (RRR). With care, often this can reveal the approximate timing of a given shower's maximum, as well suggesting how shower rates may have evolved near then.

It is important to appreciate the RRR is not a truly computed value, because there is a degree of subjectivity involved in assigning numbers to specific intervals per system. It is thus not the radio equivalent to the visual ZHR (there is no such equivalent unfortunately, hence the need for this alternative procedure), but by normalizing the assigned values to the ZHR, it is practical to compare the **patterns** of activity detected visually and by radio - just not their absolute values.

Observers' Notes

In the UK, the more fortunate SPA observers during the Perseids were located in southern Britain, approximately bounded to the north by a line from south Wales through the West Midlands to the Wash. There, better conditions were found on August 10-11, 11-12 and 12-13, joined on August 12-13 by a few lucky spots in Northern Ireland, and rather more in central-southern Scotland from about Ayr on the west coast northeast to Dundee on the east. Elsewhere, the clearer skies favoured only nights further from the peak. Several observers took advantage of the holidays to venture to darker-sky sites, with those travelling to East Anglia and southwest England enjoying the greatest success, judging by comments on the SPA's Observing Forum, and elsewhere.

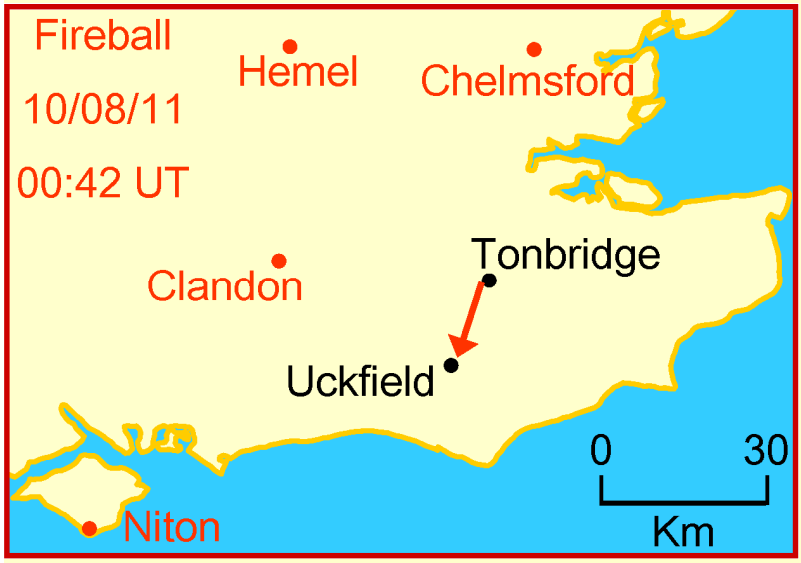
A composite photo prepared by Robin Scagell showing two of his six successful Perseid trail captures on August 12-13, from St Lawrence Bay in Essex. Perseus is to the lower centre of the shot, with the shorter Perseid trail passing just above Mirfak, α Persei, here. The photo nicely illustrates that shorter shower meteors happen nearer the radiant too.

Similarly, colleagues in North America and France found taking to the road beneficial in the hunt for clearer weather. Perhaps the most intrepid was the group with Richard Kramer, who, over two days, drove and walked to the summit of Saddleback Mountain (1255 metres/4116 feet) near the Rangely Lakes region of western Maine in the northeastern USA, for the shower's maximum night. Better still, they enjoyed some clearer weather for a time when they got there! His report of their adventure, with those of lots more, can be found among the August postings on the Meteorobs website.

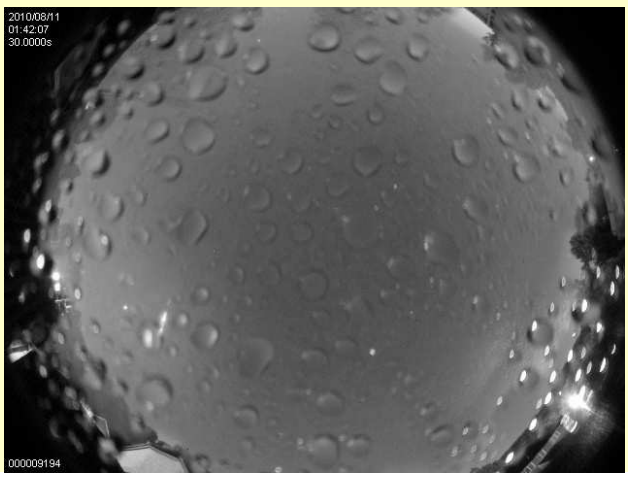
As always, grateful thanks and praise go to all our named contributors!

Triangulated Perseid Trail

August 10-11, at 00:42 UT, brought a rare multi-station fireball capture, a brilliant Perseid of at least magnitude –6. Two of the four all-sky camera stations then only very recently-established by the University of Hertfordshire at Hemel Hempstead, Herts and Niton, Isle of Wight recorded it - despite rain on the lens at Hemel! More famously, it was also caught on video by Peter Meadows at Chelmsford in Essex, though the fireball ended off his field of view. The video is available on YouTube, and shows the fireball's persistent train, which remained visible on video for three minutes! A visual observer at Clandon near Guildford in Surrey was reported in the 2010 September *The Astronomer* magazine (p. 127) as having seen it detonate in the Square of Pegasus with an iridescent blue-green colour, and confirmed the persistent train was visible with the unaided eye for three to four minutes. Herts University analyst David Campbell was able to derive a trajectory for the meteor as well, showing it flew on a roughly northeast to southwest track (heading towards azimuth 199°) above southeast England, starting at 91km altitude just southwest of Tonbridge in Kent, and ending at 72km a short way northeast of Uckfield in East Sussex, descending at 46° to the horizontal, so giving a trail length of 27km.

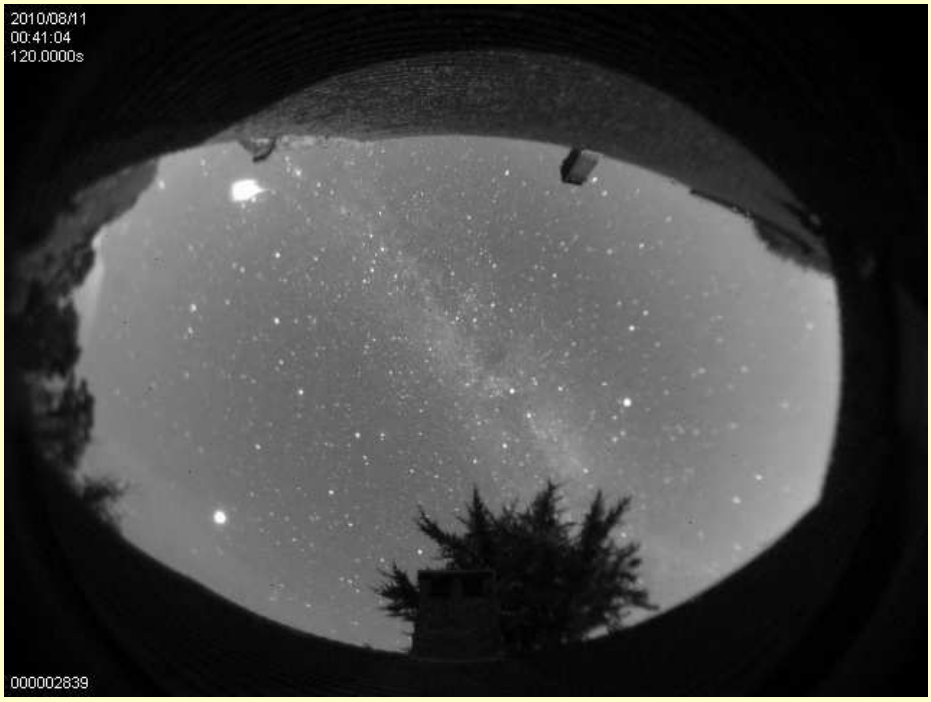


The Hertfordshire University system uses SBIG AllSky-340 cameras. The first was set up at the University's observatory at Bayfordbury, Hertfordshire in 2009 October, and ran a series of trials through to 2010 May. Its successes led to a second camera being added at Hemel Hempstead in 2010 July, followed by two more at Niton and near Cromer, Norfolk in 2010 August. This was the first meteor imaged



The August 10-11, 00:42 UT Perseid fireball as imaged at Hemel Hempstead, by the University of Hertfordshire's all-sky camera there, seen flaring brightly through the rain-splashes to the lower left. The other bright sky-object, to the lower centre-right is the planet Jupiter.

by more than one of the Hertfordshire stations, but there have been several more since - and hopefully still more to come! All the captured trails are listed on the University of Hertfordshire's website, and are detailed, with links, on the SPA's "Fireball Sightings from 2010" archive webpage, which can be accessed via the "Meteor Section Reports" segment of the Meteor homepage.



The August 10-11, 00:42 UT Perseid fireball towards the top left, as imaged at Niton by the University of Hertfordshire's all-sky camera there, with Jupiter dominating the lower left.

The same spectacular Perseid fireball, as caught in Pegasus/Delphinus by Peter Meadows at Chelmsford in Essex.

Another impressive Perseid fireball imaged by the Herts University Niton camera on the Isle of Wight, around 01:20 UT on August 10-11, meteor to the upper right, Jupiter the lower left.

Useful Internet Addresses

The SPA Meteor Section's homepage:
http://www.popastro.com/sections/meteor.htm

The SPA's Observing Forum "Perseids 2010" topic:
http://www.popastro.com/phpBB2/viewtopic.php?t=14332

The IMO's preliminary Perseid results page:
http://www.imo.net/live/perseids2010/

The UK Weather World's Space Weather Forum "Perseids 2010" topic:
http://www.ukweatherworld.co.uk/forum/forums/thread-view.asp?tid=38178&posts=1&start=1

NAMN homepage: http://www.namnmeteors.org

AKM homepage: http://www.meteoros.de

RMOB homepage: http://www.rmob.org

Meteorobs homepage: http://www.meteorobs.org

Peter Meadows' images and videos: http://www.petermeadows.com/meteor

The University of Hertfordshire's all-sky camera homepage:
http://star.herts.ac.uk/allsky

For the imaged fireball at 00:32 UT on August 12-13, from southern France, see:
http://www.bbayle.com/meteores/Perseides_00h32TU_F18mm_800iso_Pose-60s_EOS350D_Réduite.jpg

Earlier summaries of information on the 2010 Perseids were given in *SPA Electronic News Bulletins* 293, 294 and 295, archived as follows:

293: http://www.popastro.com/phpBB2/viewtopic.php?t=14452

294: http://www.popastro.com/phpBB2/viewtopic.php?t=14453

295: http://www.popastro.com/phpBB2/viewtopic.php?t=14574

Report by Alastair McBeath, Meteor Director, Society for Popular Astronomy.