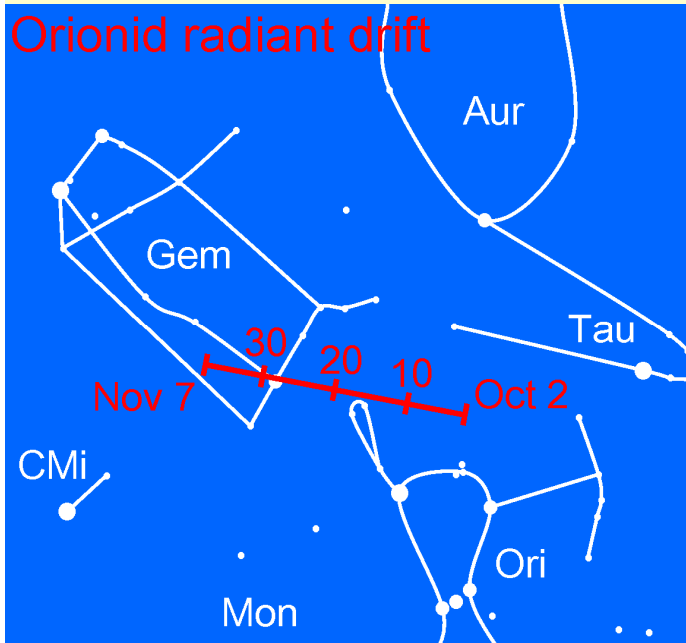


SPA Meteor Section Report

Orionids 2010

Introduction



The main Orionid maximum was due on 2010 October 21, when the radiant was near Orion's "Club" asterism, an area of sky usefully observable for meteor work from about 23h UT onwards in Britain. Unfortunately, full Moon was due on October 23, nicely-timed to spoil much of the show. However, the IAU issued an alert on October 19, suggesting the Earth was to encounter a series of dust trails shed by the Orionids' parent comet 1P/Halley at its returns between 1401 BC and 12 BC from October 20-25 inclusive. Zenithal Hourly Rates (ZHRs) were suggested as likely to be in-line with some of the recent strong returns from 2006-

2009, at ~40-50. An International Meteor Organization (IMO) analysis some years ago had indicated Orionid ZHRs could be cyclical with a 12-year periodicity, and if so, would be probably close to their best in 2008-2010, perhaps around 30 this time anyway. It was unclear what influence this might have on the proposed enhanced activity.

Although the weather and Moon seem to have deterred many visual watchers from covering the shower, the IMO's preliminary online results indicated ZHRs averaging about 30 seem to have persisted from October 20-24 inclusive, while details collected by the SPA allowed an examination of the radio results across the shower, all of which are discussed here, along with three triangulated probable Orionid trails imaged by the University of Hertfordshire's all-sky cameras in southeast England.

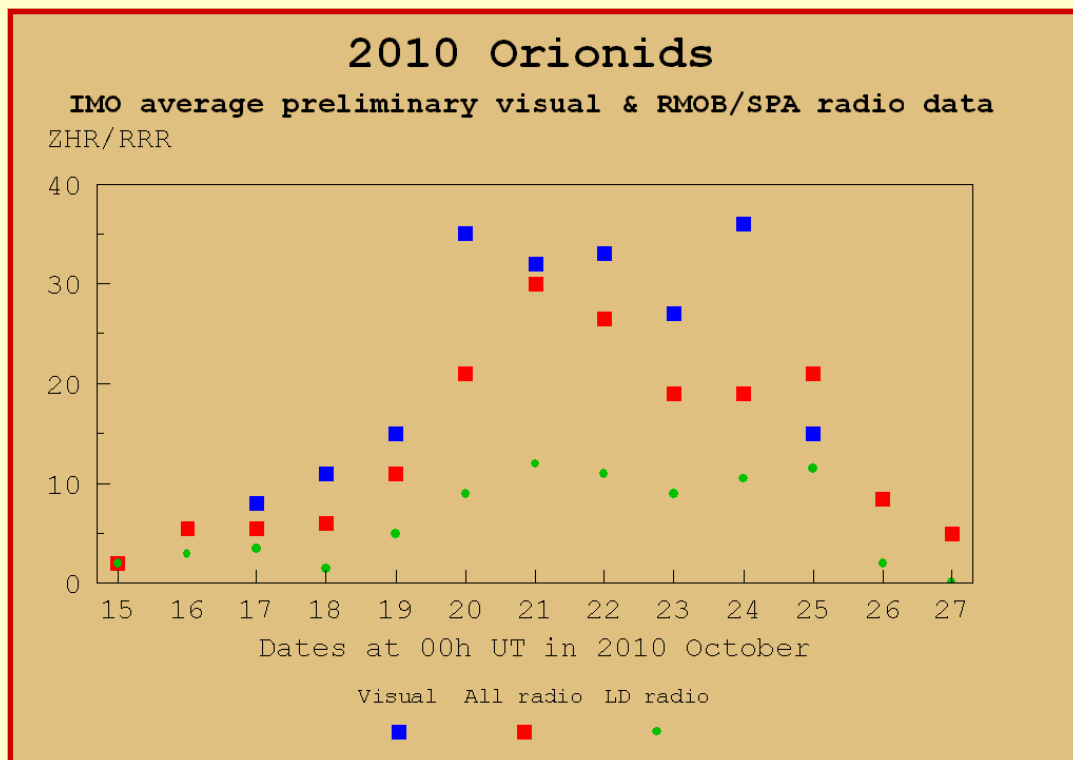
The Observers

Observers reporting to the Section were as follows. Contributors marked "V" provided visual results, "R" radio data. Some of the preliminary radio results were given graphically by David Entwistle on the SPA's Observing Forum "Orionids 2010" topic, though the detailed numerical counts used here came either directly from the observers or via Radio Meteor Observation Bulletin (RMOB) 207 for October 2010, provided by Editor Chris Steyaert. Visual results too arrived either directly, or through the kind offices of North American colleagues Mark Davis (leader of the North American Meteor Network, NAMN) and Rich Taibi. Grateful thanks go to everyone involved for their efforts!

Enric Algeciras (Spain; RMOB; R), Orlando Benitez (Canary Islands; RMOB; R), Michael Boschat (Nova Scotia, Canada; RMOB; R), Jeff Brower (British Columbia, Canada; RMOB; R), Willy Camps (Belgium; RMOB; R), Johan Coussens (Belgium; RMOB; R), Gaspard De Wilde (Belgium; RMOB; R), Franky Dubois (Belgium; RMOB; R), David Entwistle (England; RMOB; R), Kurt Fisher (Utah, USA; RMOB; R), Karl-Heinz Gansel (Germany; RMOB; R), George Gliba (West Virginia, USA; NAMN; V), Paul Martsching (Iowa, USA; V), Mike Otte (Illinois, USA; RMOB; R), Jean-Louis Rault (France; RMOB; R), Steve Roush (Arizona, USA; RMOB; R), Wayne Sanders (British Columbia, Canada; RMOB; R), Chris Steyaert (Belgium; RMOB; R), Wesley Stone (Oregon, USA; V), Dave Swan (England; RMOB; R), Dirk Van Hessche (Belgium; RMOB; R), Felix Verbelen (Belgium; RMOB; R).

Shower Review

With too few visual results submitted directly, the IMO's "live" preliminary Orionid results (2010 Nov 11 version) have been referred to heavily in the following. Average nightly values derived from those are given in the graph below, as blue squares. These showed that after a steady rise in ZHRs to October 19, they jumped up dramatically to about 35 by the following date, and persisted at somewhere between 25 and 35 until October 24 (averaging ~30 across these five dates). Late in this period, there was an intriguing dip to 27 ± 4 on October 23. Although the observing conditions mean this result was not ideally reliable, it did suggest activity continued at roughly the expected maximum level for rather longer than normal, so the prediction for unusual Orionid activity can be considered partly borne out (the extended duration of the better activity, if not the meteor numbers).



An initial indication in results reaching the SPA directly that activity for a time on October 17-18 may have been above normal too, ZHRs perhaps around 20-25, was not borne-out by the more extensive IMO results for that night, nor in the radio data.

The graph on page two also provides information from an examination of the radio meteor data, including the Relative Radio Rates, RRRs, for both the all-echo radio counts and those for longer-duration echoes only (LD; usually considered indicative of brighter meteors visually; see the box below for more on RRRs). While concurring with the visual details in suggesting a protracted period of better Orionid activity near the shower's peak in 2010, beginning on October 20, these found good Orionid rates persisted until October 25 inclusive, and gave a clear peak around October 21 and 22, with a further possible peak on the 25th, albeit one less pronounced. For all their similarities and differences, it was curious that both methods suggested shower rates seemed to have dipped on October 23, before rising again on October 24 (visual) or 25 (radio).

Variations between visual and radio shower meteor activities are not uncommon, as while the radio method is more objective, and not affected by moonlight or clouds, deriving data from the raw results is less easy and produces information which is less certain. In addition, radio systems can often detect meteors too faint to be observed visually, so can indicate something of how such "invisible" meteors were behaving too.

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.

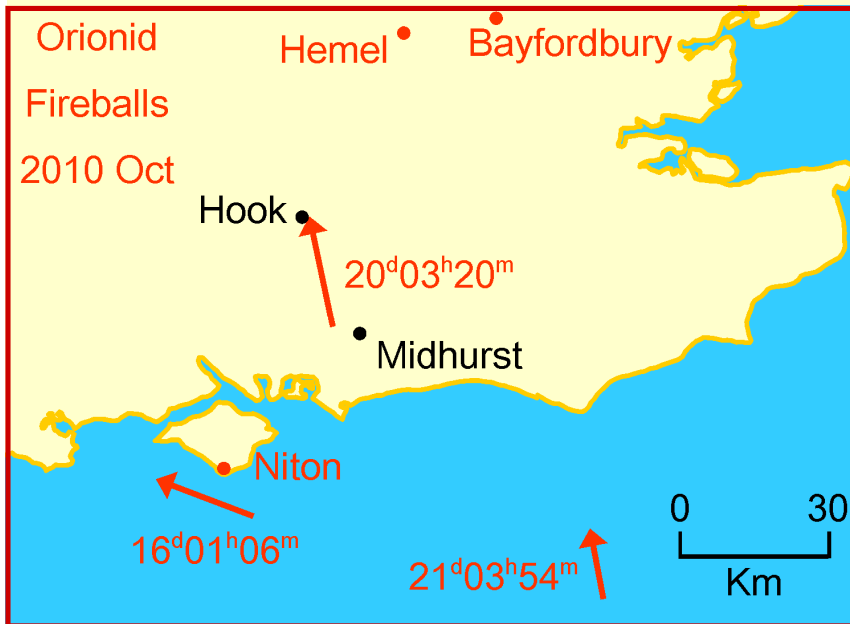
Along the way, simple numerical values are assigned to indicate when probable shower activity significantly different to normal was detected by a given observer's system. "Normal" here means periods when few or no shower meteors should have been present, as well as periods when shower meteors were detected 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.

Triangulated Orionid Trajectories

David Campbell runs the University of Hertfordshire's all-sky camera system, using 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 (also in Herts) in 2010 July, followed by two more at Niton, Isle of Wight, and near Cromer, Norfolk in 2010 August. After a number of multi-station captures by the system during August and September, three probable Orionids were caught near the shower's peak in 2010 October. All three sets



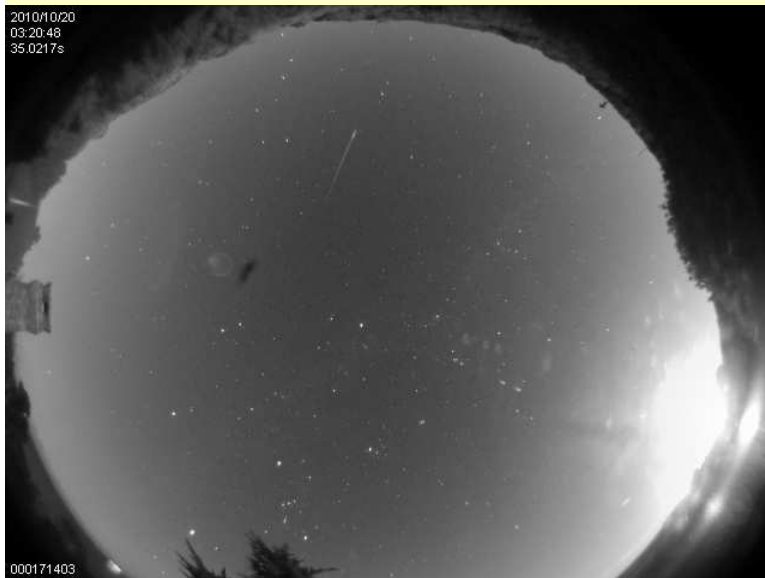
of captured trail images, with full details of the computed trajectories, are listed on the University of Hertfordshire's website, and are described, with links, on the SPA's "Fireball Sightings from 2010" archive webpage, which can be accessed via the "Meteor Section Reports" segment of the Meteor homepage. The sketch-map of SE England here with the table below, gives some basic notes for all three meteors.

Meteor	Camera Locations	Start height	End height	Trail length	Angle to horizontal	Trail heading
16 ^d 01 ^h 06 ^m	Bayfordb'y & Niton	102 ± 5 km	84 ± 0 km	34 km	31°	Az. 291°
20 ^d 03 ^h 20 ^m	Bayfordb'y & Niton	111 ± 11 km	80 ± 2 km	44 km	44°	Az. 349°
21 ^d 03 ^h 54 ^m	Hemel & Niton	107 km	80 km	33 km	55°	Az. 350°

The images for all three events are shown on the next two pages. The photos from Niton look more impressive in each case because the three meteors were higher in the sky here than for either of the other two cameras. The shots also give a contrasting series under different sky conditions, with relatively similar amounts of bright moonlight, as the Moon waxed gibbous towards full. The October 16 event was imaged despite rain splashes on both the successful cameras, while the Bayfordbury camera still had a few water droplets in view by October 20. The October 21 event had fewer clouds at Hemel Hempstead, but the meteor appeared foreshortened there, as further away. Only one of the trio occurred over land, that on October 19-20, which started a few kilometres northwest of Midhurst, West Sussex, and ended quite close to overhead for Hook in Hampshire.



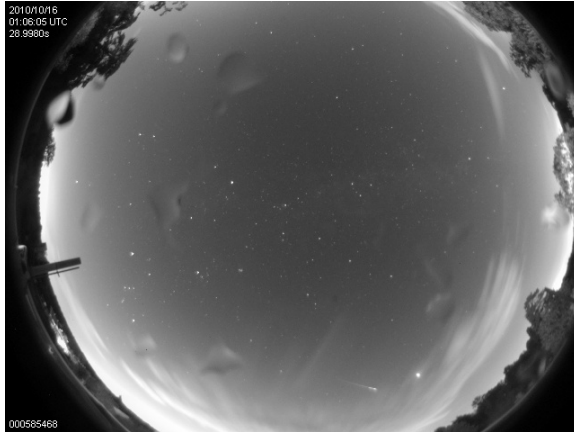
The October 15-16, 01:06 UT possible Orionid fireball as imaged at Niton, by the University of Hertfordshire's all-sky camera there, seen flaring brightly almost overhead. The bright sky-objects to the lower right are the planet Jupiter, and the setting gibbous Moon.



The October 19-20, 03:20 UT probable Orionid fireball, again as imaged at Niton, with a late flare, towards the centre-top of the photo. Note the pin-sharp stars, despite the brilliant westering gibbous Moon.



The October 20-21, 03:54 UT probable Orionid fireball, imaged from Niton, from where it just skims the outer edge of some thin clouds towards the centre left of the shot. The clouds remain brightly-lit by the setting, almost full, Moon.



Images from the Bayfordbury camera for the October 15-16, 01:06 UT (left) and October 19-20, 03:20 UT (right) meteors to compare with those from the University of Hertfordshire's all-sky camera at Niton. Jupiter is near the meteor on the earlier image, to the lower right, while the setting Moon is nearer the right horizon on both (in clouds on the earlier photo). The later meteor is only a short distance on the photo above where the earlier one appeared.



The October 20-21, 03:54 UT fireball, caught by the Hemel Hempstead all-sky camera, towards the lower left. The setting Moon and its bright lens-reflections dominate much of the lower right quarter of the shot, along with thin clouds in places.

Excellent successes for the Hertfordshire University's camera system!

Useful Internet Addresses

The SPA Meteor Section's homepage:

<http://www.popastro.com/sections/meteor.htm>

The SPA's Observing Forum "Orionids 2010" topic:

<http://www.popastro.com/phpBB2/viewtopic.php?t=14684>

The IMO's preliminary Orionid results page:

<http://www.imo.net/live/orionids2010/>

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

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

The University of Hertfordshire's all-sky camera homepage:

<http://star.herts.ac.uk/allsky>

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