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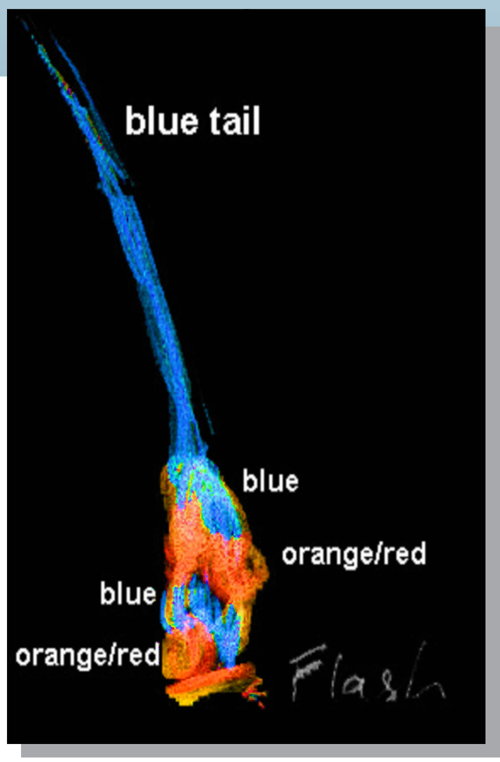

Fireballs
Shower names
Conferences
Hallowe'en special

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Administrative

Conferences

Fireballs

History

Front cover photo

Artist's impression of the shock and sound waves between Mt Taranaki (left) and Mt Ruapehu generated by the 1999 July 7 fireball over New Zealand. Painting by Ivon Warmington, Wanganui. See the article on page 135.

Writing for WGN This Journal welcomes papers submitted for publication. All papers are reviewed for scientific content, and edited for English and style. Instructions for authors can be found in WGN **31:4**, 124–128, and at `http://www.imo.net/articles/writingforwgn.pdf` .

Legal address International Meteor Organization, Mattheessensstraat 60, 2540 Hove, Belgium.

Editorial — a rose by any other name would smell as sweet?

Chris Trayner

The IAU (International Astronomical Union) has been in the news recently. It is the professional body for astronomers, and as such is more often heard in the groves of academe than reported in the public media.

Its brief moement on the public stage was occasioned, of course, by the demotion of Pluto from full planethood. Pluto was discovered by Clyde Tombaugh in 1930 and was presumed to be a planet, not an asteroid (i.e. minor planet). There were good reasons for this: an extra planet had been predicted and Pluto was in the region where one was expected. So things stood for the next three quarters of a century (about a third of a Plutonian year).

The story of Pluto's re-classification as a Dwarf Planet is well documented (Bell Burnell, 2006; Williams, 2006) and illustrates some of the problems of any classification scheme. To some extent the Universe and its Physics are a unified whole, simply existing, and all our nomenclature is an attempt to force it into things called 'categories' which help humans understand. An alternative, possibly tongue-in-cheek classification (Hollis, 1999) identifies the major planets (Jupiter, Saturn, Neptune and Uranus) and the minor planets (the rest). An even more radical one says that (to a good approximation) the Solar System comprises the Sun, Jupiter, and dust.

What have these IAU definitions to do with us? They are relevant because the IAU has the authority to define astronomical terminology. It is the IAU which issues names of newly discovered asteroids, even though it normally accepts the discoverers' suggestions. It is the IAU which allocates names to stars — or rather doesn't at the moment, and provides the authority to refute the commercial practice of taking money to 'name' a star after, typically, a deceased relative. The IAU thus has the authority to rule upon the names of meteor showers.

The IMO has recently issued a revised list of meteor shower names; for these, and the reasoning behind the changes, see (Arlt & Rendtel, 2006; Rendtel & Lunsford, 2006; Roggemans, 2006) in the last but one WGN. At about the same time, coincidentally, the IAU has been considering shower nomenclature. More specifically, Commission 22 of the IAU has been handling this; the IAU has many such Commissions, in effect sub-committees for specific topics. Peter Jenniskens presents the state of play of these deliberations on page 127.

Peter is Chair of the Task Group for Meteor Shower Nomenclature recently set up to make these decisions. He has been involved in IMO for many years, and his group's recommendations combine IMO-style letter codes with older numerical ones. It remains to be seen whether many people will use the numerical codes, or whether they will quietly wither. Note that the actual codes are not yet decided — the Task Group will decide upon them over the next year or so. They (in the person of Peter) have been talking to the IMO, and our letter codes may well end up becoming the adopted standard. We will keep you informed of progress.

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IMC 2007 and Meteoroids 2007

The IMO Council

Next year, the 'Meteoroids 2007' conference will be held in Barcelona in June. Previous combinations of IMC with 'Meteoroids' (e.g. in Smolenice and Stará Lesná) helped to establish and improve good contacts between amateur and professional meteor workers. A query during IMC 2007 in the Netherlands showed that approximately 2/3 of the IMC 2006 participants would attend an IMC in June 2007 if it also allowed them to attend 'Meteoroids 2007'. Another query via the IMO news list gave essentially the same result.

It is impossible to please everyone; June is not the best month for many people to travel. On the other hand, there may be people for whom a September IMC has always been impossible. Moreover, some observers may be observing the expected September 1 α-Aurigid outburst from North America, precluding a September IMC.

IMC 2007 will take place in Bareges, north of the Pyrenees close to the Pic du Midi observatory from 2007 June 7–10. 'Meteoroids 2007' will take place in Barcelona from 2007 June 11–15. By arranging IMC like this we want to emphasize the possibilities for interaction between the amateur and professional communities. The IMO Council hopes that many people from both 'sides' will use this opportunity to learn more about running projects and recent results. Transport from Bareges to Barelona will be organized by François Colas of the IMC Local Organizing Committee (contact imc2007@imo.net). Information will be available soon on the IMO web page as well as on the 'Meteoroids 2007' web page. We hope to see many meteor enthusiasts at both conferences.

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From the IMO Council

Jürgen Rendtel and Marc Gyssens

In June we started to report information about activities of the IMO Council. Now, after the very successful IMC in September, we want to continue this series.

One of the annual discussions among the Council members deals with the allocation of IMO support for meteor projects in connection with the attendance of the IMC. Over the past years, the IMO has spent a substantial amount of money for such supports.

Year	Total	Projects	People from
2000	€1319	10	Bulgaria (5), Jordan (2), Poland (2), Yugoslavia (1)
2001	€2075	11	Bulgaria (2), Poland (5), Romania (3) Ukraine (1)
2002	€1850	8	Belarus (3), Romania (4), Ukraine (1)
2003	€1800	7	Belarus (1), Bulgaria (2), Japan (1), Romania (2), Russia (1)
2004	€680	6	Poland (1), Romania (4), Russia (1)
2005	€1510	4	Canada (1), China (1), Romania (1), Venezuela (1)
2006	€1520	5	Argentina (1), Romania (1), Russia (1), Ukraine (1), Venezuela (1)

The money for such support is collected from supporting membership and gifts. Otherwise such support would not be possible for an organization like the IMO, and we greatly acknowledge all extra payments which help people from all over the world to participate in the IMO's work. However, this also means that we can continue supporting interesting projects only if we receive this kind of support from our members also in the future. Despite the fact that we have to increase the IMO membership fee for 2007 due to larger costs for printing and mailing our Journal WGN, we would like to encourage supporting membership.

Another intense debate went around the organization of the IMC in 2007. The possibility to combine our conference with the 'Meteoroids 2007' in Barcelona looks very attractive. Meteor astronomy is one of the fields where observations and analyses based on amateur data are widely used by professionals and sometimes the difference between the two is hardly to see. Seen the success of such combinations in the past, for example in Smolenice and Stara Lesna, we decided to choose 2007 June 7–10 for the next IMC, and we hope that many IMO members use this opportunity to come in contact with the professional meteor workers.

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The I.A.U. meteor shower nomenclature rules

Peter Jenniskens [1]

The International Astronomical Union at its 2006 General Assembly in Prague has adopted a set of rules for meteor shower nomenclature, a working list with designated names (with IAU numbers and three-letter codes), and established a *Task Group for Meteor Shower Nomenclature* in Commission 22 (Meteors and Interplanetary Dust) to help define which meteor showers exist from well defined groups of meteoroids from a single parent body.

Received 2006 October 15

1 Introduction

Commission 22 of the International Astronomical Union is concerned with all aspects of meteors and with interplanetary dust. It falls under IAU Division III (Planetary Systems Sciences) and is currently chaired by Dr. Pavel Spurný of the Ondřejov Observatory.

The International Astronomical Union has the task of defining astronomical terms and giving names to entities in space whenever needed to further astronomical research. Most recently, it labored over the definition of 'planet' and created a category of 'dwarf planets' to which Pluto belongs. Until now, meteor showers have not been named officially, as a result of which there is much confusion in the literature. Some streams are well defined but have multiple names (Draconids, gamma-Draconids, October Draconids, Giacobinids, Giacobini-Zinnerids), while many others are only ill defined and in each detection are given a different name.

During the IAU General Assembly in Prague on August 24, Commission 22 established a new *Task Group for Meteor Shower Nomenclature*, confirmed at the subsequent Division III meeting, with the objective of formulating a descriptive list of established meteor showers that can receive official names during the next IAU General Assembly (Spurný & Borovička, 2006). The objective of this action is to uniquely identify all existing meteor showers and thus enable studies of associations between meteor showers and potential parent bodies among the many Near-Earth Objects that are being discovered. Each new shower is a historic document of past cometary activity and has the potential to identify what NEOs are now dormant comets.

The *Task Group for Meteor Shower Nomenclature* will work from a working list of $\sim$ 230 showers compiled from past publications (Jenniskens, 2006). Each proposed shower was given a name, as well as a unique number and a three-letter code to be used in future publications that discuss the recovery of the streams in orbit surveys and other types of observations. Many of these showers need further study to establish whether or not they represent streams of meteoroids from a single parent body. The three-letter code is based on the codes used by IMO (in conference with IMO president Jürgen Rendtel), while the IAU numbers go back to a system of numbers introduced in the work at the Harvard Smithsonian Center for Astrophysics and now used by the IAU Meteor Orbit Data Center, by simply adding to the numbers given to potential meteor showers in the past. The designated names are mostly traditional, adhering to a system of nomenclature rules given below, but accepting that it is not always known what is the nearest star to the radiant position at the time of the peak of the shower.

2 Meteor shower nomenclature

The general rule is that a meteor shower (and a meteoroid stream) should be named after the then current constellation that contains the radiant, specifically using the possessive Latin form. The possessive Latin names for the constellations end in one of seven declensions:

- -ae (e.g., Lyrae),
- -is (e.g., Leonis),
- -i (e.g., Ophiuchi),
- -us (e.g., Doradus),
- -ei (e.g., Equulei),
- -ium (e.g., Piscium), or
- -orum (e.g., Geminorum).

Custom is to replace the final suffix with '-id', or plural '-ids'. Meteors from Aquarius (Aquarii) are Aquariids, not Aquarids. An exception is made for meteors from the constellation of Hydrus, which will be called 'Hydrusids', in order not to confuse with meteors from the constellation of Hydra.

When the constellation name has two parts, only the second declension is to be replaced by 'id'. Hence, meteors from Canes Venatici (possessive Canum Venaticorum) would be 'Canum Venaticids'. When two constellations are grouped together, a bracket is used and both constellation names will have 'id'. Hence, Puppids-Velids.

If a higher precision is needed, then the shower is named after the nearest (if in doubt: brightest) star with a Greek letter assigned, as first introduced in the Uranometria atlas by Johann Bayer (1603), or one with a later introduced Roman letter. If in doubt, the radiant position at the time of the peak of the shower

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(in the year of discovery) should be taken. Hence, the meteors of comet IRAS-Araki-Alcock would be named 'eta-Lyrids'.

Following existing custom, one may add the name of the month to distinguish among showers from the same constellation. In this case, one could call the shower from comet IRAS-Araki-Alcock the 'May Lyrids', in order to differentiate from the more familiar 'April Lyrids'.

For daytime showers, it is custom to add 'Daytime', hence the name for the 'Daytime Arietids' in June as opposed to the Arietids in October.

South and North refer to 'branches' of a shower south and north of the ecliptic plane, resulting from meteoroids of the same (original) parent body. Because they have nearly the same longitude of perihelion at a given solar longitude (the argument of perihelion and longitude of ascending node differing by 180° between South and North), the two branches are active over about the same time period.

If the meteoroid stream is encountered at the other node, it is customary to speak of 'twin showers'. The Orionids and eta-Aquariids are twin showers, even though each represent dust deposited at different times and are now in quite different orbits. As a matter of custom, twin showers and the north and south branches of a stream carry different names.

Meteor showers are not to be named after their parent bodies (e.g., Giacobinids, IRAS-Araki-Alcockids). The names of comets tend not to be Latin, making the naming not unique. Also, comet names can change when they get lost and are recovered.

3 Implementation

The Task Group for Meteor Shower Nomenclature will choose among possible alternative proposed names for newly identified meteor showers, in order to establish a unique name for each meteor shower (e.g., eta-Lyrids, not May Lyrids).

This working list and the nomenclature rules below will be posted at the website of the IAU Meteor Orbit Data Center and that of IAU Commission 22, which will also keep a list of the members of the Task Group and contact information. In the coming years, this working list can be extended with newly identified meteor showers, when sufficiently detailed information is available. In two and half years from now, half a year before the next IAU General Assembly in Rio de Janeiro (Brasil), a subset of all showers will be selected for inclusion in the list of established meteor showers. The list of established meteor showers shall also be posted at the IAU Meteor Orbit Data Center website: `http://www.astro.sk/~ne/IAUMDC/Ph2003/` .

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Conferences

Proceedings of the International Meteor Conference, Oostmalle, Belgium, 2005

In 2005, for the first time in many years, an IMC was held in Belgium. Those who attended will remember the interesting talks, the opportunities to talk with the speakers and the informal conversations on meteor topics. Some flavour of this can be found in WGN 33:5, pages 116-117.

For those who did not go, the full papers are published in the Proceedings, now in print. Purchasing details can be found on the website `http://www.imo.net/imo/publications/proceedings`, with purchasing instructions at `http://www.imo.net/imo/publications` . For those who might want to buy, the full abstracts are printed below.

Report on the second Radio Meteor School, September 10–14, 2005, Oostmalle, Belgium

Cis Verbeeck and Jean-Marc Wislez

Just before the IMC 2005, twelve radio meteor workers gathered in Oostmalle, Belgium, to participate in the Radio Meteor School 2005, a high-level tutorial on radio meteor astronomy. At the IMC, Jean-Marc Wislez and Cis Verbeeck presented a short talk about this event, largely featuring many photographs, showing the serious devotion and results obtained and sketching the general atmosphere. It is a hard task to try and do the same in the present text, without so many pictures. A nice report was already given by Danica Pajović in WGN (**34:2**, p. 37).

Parameters of a forward scatter radio meteor set-up: Preliminary calculations for the MSR radio meteor project in Argentina

Juan Martín Semegone and Juan A. Sanz

The MSR set-up was developed considering several parameters related to radio astronomy calculations for the observing system, neighborhood environmental characteristics, and many conditions related to the placement of the instrument. In the present work a forward scatter radio meteor link is analyzed to obtain the required parameters for a meteor radio astronomy dedicated set-up. The analysis is illustrated by calculating the parameters for the MSRV2 system employed at the Instituto Argentino de Radioastronomía (IAR).

Meteor forward scattering at multiple frequencies

Saša Nedeljković

Meteor forward scattering is a well known method of detecting meteors using a radio telescope to receive signals from distant transmitters scattered from a meteor trail. The traditional way of performing the meteor forward scattering is to tune the receiver to some particular frequency to match a distant transmitter and wait for reflected signals. In this paper I will show how new technologies can be used to make a simpler digital radio telescope capable of analyzing broadband spectra from 0 to 250 MHz. Such spectra contain information about several reflections on a single meteor, which can be enough to calculate the meteor's kinetic parameters.

The VVS meteor beacon

Chris Steyaert

This presentation describes the construction of a dedicated meteor radio beacon, the first results achieved with it, and the future plans.

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Concept and presentation of a Unified Meteor DataBase

Geert Barentsen

Large collections of meteor data play an important role in meteor research. It is observed that current databases are often outdated, incompatible or difficult to access. We propose an online Unified Meteor DataBase (UMDB) that supports any standardized meteor data collection. A pilot implementation has been established and demonstrates the potential.

Meteor observations at Modra Observatory

Pavol Zigo, Štefan Gajdoš and Juraj Tóth

The Astronomical and Geophysical Observatory of Comenius University in Modra is introduced. Interplanetary matter research, including meteor observations, is an important part of research activities here. Meteor observation methods and instrumental equipment at present and subsequent plans are described.

Perseids 2005 results in Romania

Valentin Grigore, Ştefan Berinde and Alexandru Conu

Since 1993, *Perseide* (Perseids) is the most important astronomical event in Romania. It changed the history of the Romanian popular astronomy and consecrated the meteor work and the meteor education in Romania. The thirteenth edition was one of the best, with good participation and entirely clear skies between two periods of massive rainfall in Romania.

A list of meteorite falls and their impact craters from ancient Chinese records (7^{th}–19^{th} century)

Nagatoshi Nogami

Eighteen meteorite falls and their impact craters from ancient Chinese records before 1911, compiled in a Beijing Observatory (1988) publication, are listed. Some of the reports gave no information of meteorite mass and crater diameter. However, by supplementary calculated mass from their volume, data characteristics and impacting behavior of the listed meteorites are discussed in detail.

Polish Fireball Network

Arkadiusz Olech, Przemysław Żołądek, Mariusz Wiśniewski, Mirosław Krasnowski, M. Kwinta, T. Fajfer, K. Fietkiewicz, D. Dorosz, Ł. Kowalski, J. Olejnik, K. Mularczyk and K. Złoczewski

The overview of the project called *Polish Fireball Network* is given. Its main goal is multi-station recording of bright meteors occurring over the territory of Poland using video and photographic techniques. Such observations of meteoroids passing through the atmosphere provide information about their orbits and population of the interplanetary bodies in the size range from 0.1 to several meters. For the brightest events it is possible to compute orbits, atmospheric trajectories and most probable impact points of meteorites.

The brief description of the history of the project and its current status is presented. The information about the equipment used is also provided. An example result, concerning the determination of orbit and trajectory of the PF200505a "Szczekociny" fireball, is described.

Least squares estimation of a meteor trajectory and radiant with a Gauss-Markov model

Eduard J. A. Bettonvil

A Gauss-Markov model is worked out to calculate the trajectory and the radiant of a simultaneously observed meteor. With this model the radiant and the precision of the radiant, which is a 95 %-confidence-ellipse, is calculated from a simultaneously video-observed meteor that appeared over the Netherlands on 2001 April 22, $01^{h}27^{m}23^{s}$ UT.

The radiant ephemerides of κ-Cygnids from the IMO video database

Mihaela Triglav-Čekada

The analysis of single-station IMO video network data of the July and August period with 36 576 meteors in search of κ-Cygnid, α-Lyrid and ζ-Draconid meteor showers was made using the program Radiant. These showers will be named κ-Cygnid meteor complex radiants. The detailed analysis of the whole August period from 1993–2004 included the behavior of radiants in different magnitude ranges and different years from 2000 on. Detailed radiant calculations for different velocities for 5° and 10° solar longitude intervals were also done. In 10° solar longitude intervals also the calculations for different magnitude ranges were conducted. The activity of the κ-Cygnid radiant and the α-Lyrid radiant was proven, unlike the ζ-Draconid radiant, where no activity could be confirmed. For the whole August period also the behavior of radiants in separate years 2000–2004, when day-to-day meteor coverage is available, was made. From that it can be hinted on alternating bigger activity of the κ-Cygnid and α-Lyrid radiants. In the years 2000 and 2001 the α-Lyrid radiant is more active, when on the contrary in 2002, 2003 and 2004 the κ-Cygnid radiant is more active. The year 2003 is interesting from another aspect, as three radiants can be seen. If the third radiant is the ζ-Draconid radiant, a few years more video observations will have to be gathered and the radiant calculations repeated.

For the day of the κ-Cygnid meteor complex maximum, on August 18, the mean radiant positions were deduced: the more active κ-Cygnid radiant lies at $\alpha = 280°$ and $\delta = +58°$ with an area of the maximum probability of $10° \times 15°$, and the less active α-Lyrid radiant is placed at $\alpha = 292°$ and $\delta = +52°$ with a radius of maximum probability of 2°. The radiant drift was not possible to obtain as in the 5° and 10° solar longitude interval calculations the positions of both radiants apparently oscillate. As no change can be seen in the position of the radiants and their appearance when changing the velocity, it can be concluded that they present subbranches of the κ-Cygnid meteor complex radiant.

Polish Automated Video Observations (PAVO) 2002–2005

Mariusz Wiśniewski, Arkadiusz Olech, Przemysław Żołądek

We present the history and statistics of the Polish Automated Video Observations project between 2002 and 2005. PAVO is a non-intensified system. We made 7839 hours of observations and recorded 11374 meteors. There are 26 cameras working in the Polish Fireball Network. Typical PAVO cameras record about one sporadic meteor per hour with a limiting magnitude of +2.

A digital all-sky camera

Felix Bettonvil

We present an automated digital all-sky camera based on a Nikon Coolpix 4500 with FC-E8 fisheye lens.

A camera for observing meteors from space – the Smart Panoramic Camera Head (SPOSH)

Detlef Koschny, A. Marino, J. Oberst

This paper presents the results of a study to design a camera to observe meteors from space.

A trace of fireball stream activity in August 2005

Przemysław Żołądek, Arkadiusz Olech, Mariusz Wiśniewski

Four bright meteors and fireballs were observed by photographic and video cameras a few days after the Perseid maximum. All paths of these meteors create a slightly diffuse radiant with coordinates $\alpha = 238°$ and $\delta = +62°$. Two approximate orbits are presented. An association with the κ-Cygnids complex is noticed.

Study of meteor shower evolution using old and recent data

Jürgen Rendtel

Evolution of meteoroid streams takes place typically over periods of several orbital periods. Therefore, long term studies based on one technique should reveal effects of the stream's evolution. In the optical range, visual observations are available for decades. It is necessary to transfer these into comparable formats and to apply one analyzing procedure to the whole data set. Calibration problems are discussed and the evolution of the Geminids over more than 60 years is given as an example. Interesting and suitable candidates for long-term studies are the Quadrantids, the Perseids, and the Orionids.

The mass distribution of the Leonids

Huan Meng

The mass distribution and its evolution of the Leonid dust trails are investigated, by means of deducing the relationship between the mass index and the semi-major axis difference between the dust particles and the comet. Phenomenological fit is performed to test the evolution function, for which we have no physical basis to theoretically derive. The equations obtained accord with the historical observations very well. These enable us to numerically predict the observational population indices of the Leonid dust trails, and provide some new tools on observation analysis, e.g., the criterion for distinguishing mixed dust trails. In addition, our work suggests the fragmentation of dust particles dominates the evolution trend. This is in agreement with the conclusions from other aspects. All these results together reveal a new scenario for the physical evolution of meteoroids.

Meteor Contemporary Poetry Project

Andrei Dorian Gheorghe

The history and future of the astropoetry project in IMO is discussed with an overview of the evolution during the last 10 years, some comments and points of attention to the future.

Parents of meteors (2)

Andrei Dorian Gheorghe

Some brief sections about meteor poetry in Romanian history are presented, together with a short biography of Alexandru Anestin and Harald Alexandrescu, two famous Romanian astronomers.

Observations of telescopic meteor showers

Radosław Poleski, Konrad Szaruga

Conclusions from an experiment which was carried out at Warsaw University's Observation Station in Ostrowik in the period 1–15 of July 2005 are presented. Over 182 hours of simultaneous telescopic and video observations were made by the Comets and Meteors Workshop (CMW) observers. During this time 17 multiple meteors, plotted 28 times, were obtained. Huge differences between telescopic and video observations were remarked. Tilt and shift standard deviation were measured. A preliminary analysis of o-Draconids, α-Cygnids and July Lyrids is presented.

Light pollution and observing meteors

Diana-Maria Ogescu

Year after year light pollution has eroded the night sky to such an extent that it threatens the existing areas of dark skies in the countryside as well. A large percentage of the light is not reaching the ground, where it is needed: it goes outward and upward in a totally useless manner. Light pollution affects the observing statistics, and the meteor observers' health. That is why the actions to preserve or extend the existent observational facilities must be intensified. Meteor observers from all over the world warn about and must be warned about the danger of losing sight of the night sky.

Radiant mapping with forward scatter radars: a new approach

Stefano Ferretti, Giuseppe Pupillo, Giordano Cevolani, Giorgio Grassi

In this paper we describe a method to map radiant positions of meteor streams developed for forward scatter radars with the ability of measuring the angle of arrival of meteor echoes. A system with these qualifications, called MIRA (Meteor Interferometric Radar Array), will soon replace the actual BLM radar system in Italy. Preliminary results from numerical simulations are also shown here.

Identification of the first Martian meteor

Jérémie Vaubaillon, Franck Selsis, M. Lemmon, J. Bell

We present here the first detection of a meteor in the Martian atmosphere. The event occurred on March 7$^{\text{th}}$, 2004 and was detected by the rover Spirit (NASA/JPL). The orientation of the streak makes it most likely to come from comet 114P/Wisemann-Skiff. The possibility that it came from the Viking Orbiter spacecraft is ruled out by the light curve. These results form the basis of the study of Martian meteor showers.

Simulating meteor showers in the Martian atmosphere

Jonathan P. McAuliffe, Apostolos A. Christou

In an attempt to begin to quantify the Martian meteor year, we have simulated meteor shower detection in the Martian and terrestrial atmospheres. Assuming a meteoroid stream flux, size distribution and velocity based on current knowledge of Earth streams as well as the proximity of certain comets' orbits to that of Mars, we numerically integrate meteoroid ablation in model Martian and terrestrial atmospheres. Using the same baseline detector characteristics (limiting magnitude, sky coverage) we have generated detection statistics for the two planets. We present results for four showers, including strong annual activity and velocity extremes from Halley-type comets at both planets. We show that for high speed showers similar detection rates can be expected at both planets but for showers with low approach velocities very low mass indices would be required to produce detection rates greater than 10 per hour at Mars. Finally we will comment on what these findings mean in terms of monitoring the Martian atmosphere for meteor activity.

Perseids 2005 – first results from MBK team observations

Javor Kac

The Youth Astronomical Research Camp (MART 2005) took place on Pohorje Mountain, Slovenia from August 5 to 14, 2005. The meteor group used visual, photographic, video and radio techniques to follow the Perseid activity. Fourteen observers obtained 208 hours of visual observations and recorded more than 7500 meteors. Almost 90 meteor trails were photographed using film and digital cameras. Using a video camera, 411 meteors were recorded. This paper presents the first results from visual, photographic and video observations.

A^{3}N – Alpe-Adria All-sky Network

Javor Kac

There are several all-sky cameras operating each clear night in the Alps/Adriatic Sea region. This project's goal is to join the individual stations to allow prompt communication in case of bright fireballs. Currently operating stations and plans for the future are presented.

Orbit calculation of the August 15, 2002 fireball over the Netherlands

Felix Bettonvil

On August 15, 2002 at $23^h03^m50^s$ UT a very bright meteor appeared above the western part of the Netherlands. The fireball, with an estimated magnitude of -8, and visible for about 4 seconds, was simultaneously photographed by three Dutch all-sky cameras operated by members of Dutch Meteor Society and the KNVWS Meteor Section, set up at Oostkapelle, Benningbroek and Hoogmade. Measurements of the three all-sky images and calculation of the trajectory indicated a low vanishing height of the fireball, slightly less than 40 kilometers, and a clear deceleration. The calculated heliocentric orbital elements show similarities with members of the ι-Aquarid shower, and correspond extremely well with the anti-helion ecliptical sporadic background.

Towards a calibration of meteor counts with the Mintron video system

Daniel Fischer

With the availability of highly sensitive CCD surveillance cameras around mid-2002, namely the Mintron 12V1C-EX, video monitoring of meteor showers has suddenly become an attractive option for "the masses". While not as sensitive as the image-intensified systems used in the amateur community since circa 1993, they are cheaper, easier to use and less easy to break. The question naturally arises how the rate of meteors counted in Mintron videos compares to visual rates recorded from the same location as well as to the global ZHR profile calculated by the IMO.

Here preliminary results are presented from two observing runs during the maxima of the Perseids in 2004 (from Romania) and 2005 (from Germany). On average it is found that the Mintron-"Video-ZHR", when the camera is equipped with a 6 mm f/0.8 lens and set to an integration factor of a few frames (to be able to use their shortlived wakes for a slight increase in limiting magnitude for meteors), hovers at about 1/3 of the visual ZHR on average, regardless of whether the latter is calculated globally by the IMO or by the DMS only from their own observers. But the ratio IMO/video varies widely, even for rather long intervals of thirty minutes or one hour, raising many issues.

The song of the IMC

Jérémie Vaubaillon

The International Meteor Conference is an annual occasion to share latest work and observations of meteors. It is also the time for cultural events, such as astropoetry, usually presented by A. D. Gheorghe. In this paper, we provide the lyrics of the so called "Song of the IMC", first composed and presented at the 2004 conference, as well as the corrected version and the 2005 version.

Fireballs

The Taranaki daylight fireball, 1999 July 7

Jennie McCormick [1]

The New Zealand Taranaki Daylight Fireball was observed on 1999 July 7 from various areas across the North and South Islands of New Zealand and had an apparent magnitude brighter than −20. The event produced more than one hundred handwritten reports, drawings, and paintings from eyewitnesses; video and audio recordings, seismic trace data, and confirmation of detection by the United States Defense Department satellites. A detailed case study based on this data shows that observations by the public are invaluable when compiling a formal history of such events.

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1 Introduction

On 1999 July 7 at 16^h20^m (04^h20^m UT), the Stardome Observatory in Auckland received a telephone call from a member of the public who claimed to have witnessed a golden ball, as bright as the Sun with a very long tail, speeding through the sky in a southerly direction. Subsequently, numerous eyewitness reports were received from around New Zealand.

Media statements were issued to help alleviate fears of an aircraft disaster, satellite re-entry or UFO landing, and to give a scientific explanation for the event.

2 Data collection methods

The general public were encouraged to report their sightings directly to the Stardome Observatory, instead of police stations and media centres.

2.1 Fireball report forms

After logging the first few calls a new Fireball Report Form was designed. The original report form had been in use for a number of years and proved confusing for the general public. Most observers did not fully understand many of the questions listed on the form and, because of this, had difficulty in providing relevant and important information. A new form was designed and modeled on the International Meteor Organisation Fireball Report Form (IMO, no date). A prepaid envelope ensured that the majority of reports were returned within a matter of days.

The Stardome Observatory logged 115 written Fireball Report Forms over 14 days.

2.2 Videos and photographs

The extensive media coverage of the event proved invaluable as it prompted holidaymakers to send in photographs of the fireball as it traveled through the atmosphere above New Zealand.

The Stardome Observatory also received various videotaped recordings of the fireball in flight, its detonation and explosion cloud. One of the videotapes included the audible sonic boom from the bolide on detonation.

2.3 Telephone

A number of reports were originally received by telephone. However, it soon became clear that accurate reporting of information was difficult through this medium, as many of the callers were understandably very excited about what they had just seen and found it difficult to convey clearly the information required. Additionally, some observers were calling long distance from around New Zealand at their own expense and, often in haste, questions were being over-looked.

Therefore, it was decided to post a Fireball Report Form to each observer with a prepaid envelope. This allowed each observer time to compile their report in a relaxed manner, improving the value of their contributions.

2.4 Individual interviews

Reporting any unusual event accurately can be a difficult task, particularly for inexperienced observers. From the 115 written fireball reports received, 61 were used to calculate the approximate entry point, speed of the fireball across the North Island of New Zealand, and the location and height of its final detonation.

The critical parameters were the observer's geographic location and the altitudes for the first and last sighting of the fireball. For 45 eyewitnesses, the altitude question in particular proved difficult and the accuracy of their reports were questionable. Therefore, a decision was made to personally interview crucial observers over the telephone, and when needed, interview the observer in person for further information.

Unfortunately, only a small number of observers were able to accurately report on the fireball's track. Four eyewitnesses used global positioning systems; one observer used a theodolite, and an experienced pilot en-route to Auckland Airport provided a highly accurate report of the event as seen from the cockpit of the aircraft. Based on these accounts including the many drawings and videotaped footage received, this suggests the bolide would have entered the atmosphere at a highly inclined angle.

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IMO bibcode WGN-345-mccormick-fireball
NASA-ADS bibcode 2006JIMO...34..135M

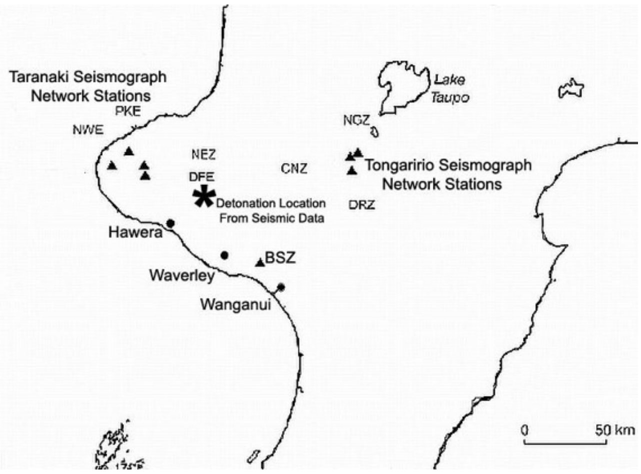

Figure 1 – Taranaki and Tongariro Seismograph Network Stations. (Geological and Nuclear Sciences New Zealand Ltd.)

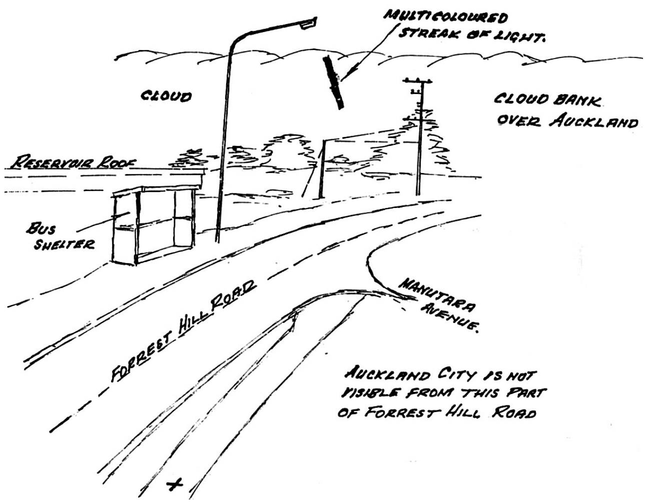

Figure 3 – Drawing by Peter Goldsbro, Auckland. Observed from about 20 km north of Auckland city, on the 'Northshore'.

2.5 Seismic records

Geological and Nuclear Sciences have confirmed the general public's reports and observations of ground movements and tremors experienced (Manville et al., 2004). Eighteen seismograph stations recorded shock waves from the detonation of the bolide. These stations form part of the geological hazards monitoring network in New Zealand.

Taranaki Seismic Station BSZ, a key volcanic monitoring network station in the Taranaki region, recorded the shock waves from the detonation. Known as Event 1411185, the trace from Seismic Station BSZ clearly shows the shock waves generated by the detonation of the bolide (Figures 1 and 2). The detonation of the Taranaki fireball registered a shockwave equivalent to ~ 3.9 on the Richter scale (Manville et al., 2004).

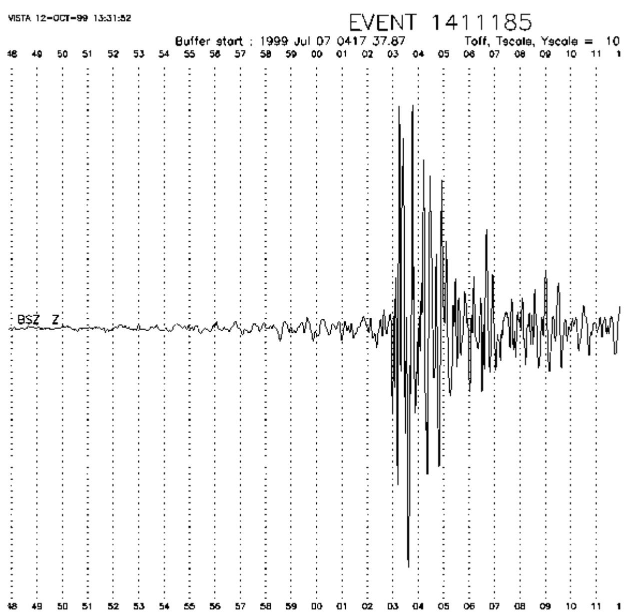

Figure 2 – Event 1411185 seismic trace. (Geological and Nuclear Science New Zealand Ltd.)

3 Results

3.1 The fireball track

Based on the written reports and drawings obtained from the general public, visual observations of the fireball and its detonation have been grouped into six regions around New Zealand (Figure 8).

The majority of eyewitness reports record that the object was moving either 'very fast' or 'speeding' through the sky.

All eyewitness observations record the duration of the fireball's flight as being between three and five seconds.

- **Northland Region.** Three observers from the far north of New Zealand provided roughly concordant descriptions: A black and yellow object heading south, half as bright as the Sun and about the 'size of a tennis ball at a distance of 20 meters' with a bright orange tail trailing behind.
- **Auckland Region.** Thirteen observers gave similar descriptions with one exception. They described a long object with a bright white/gold head and a red/orange tail twisting and glinting like 'fiery flames' (Figure 3). All of these observers stated it was as bright or brighter than the Sun and heading south. One observer sitting in a viewing car park at Auckland International Airport described a black and yellow oblong object with a long yellow/orange tail heading southward.
- **Waikato Region.** Observers reported a bright orange/blue violet glowing ball, with a long blue grey tail (Figure 4). Observers in the Northern Waikato areas were the only observers to report the colours blue and violet in the fireball's descent across the North Island.
- **Central and Lower North Island Regions.** These observers gave comparable reports describing a very bright white object with a long bright yellow/orange tail.

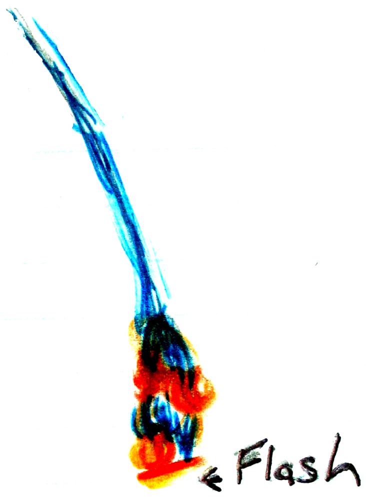

Figure 4 – Drawing by Lyn Loveridge, Huntly (31 km north of Hamilton). This is reproduced in colour on the front cover.

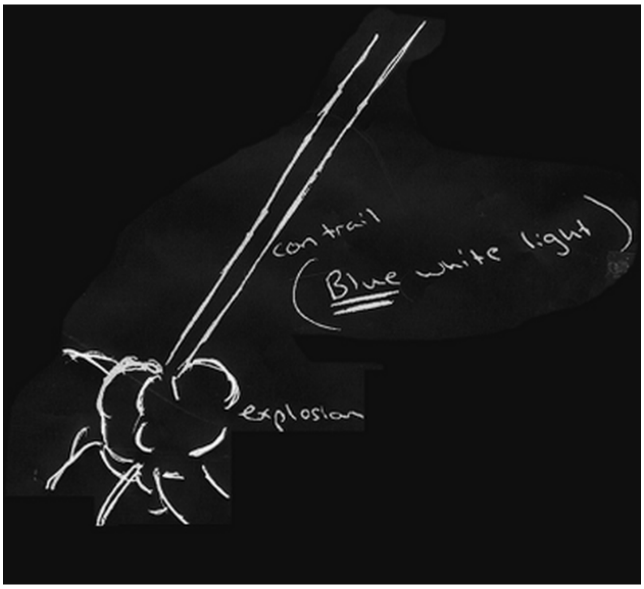

Figure 5 – The terminal blast by H.Lovell-Smith, Waitara, Taranaki District (36 km north-east of Mount Taranaki).

All reported the object was heading in a southerly direction and was as bright as the Sun.

- **Taranaki Region.** The Taranaki district produced the majority of eyewitness reports.

  Observers described a very bright silver/yellow object abruptly detonating in a spectacular burst of intense bright blue/white light (Figure 5).

- **South Island Region.** These reports came from as far south as Geraldine (171°15E, 44°5S).

  Three of the observers provided informative reports of a bright red/orange teardrop shaped object in the northern sky heading in a westerly direction.

  The upper South Island observers all describe looking north at an incredibly bright white and golden ball speeding in a westerly direction with a yellow tail.

3.2 The terminal blast

The terminal blast was seen by observers 285 km to the North (Auckland Airport), 572 km to the South (Brightwater) and 215 km to the East (Te Puke) of the detonation point which occurred over the towns of Hawera and Waverley in the Taranaki Region.

The explosion was described as a flash of blinding light from which a vivid blue and white compact cloud emitted leaf-like objects.

One observer likened the explosion to that of the Space Shuttle Challenger disaster, with ribbon-like smoke trails shooting from the explosion in all directions.

All observers stated that a large bluish white smoke cloud hung around in the late afternoon sky for 40–50 minutes until finally dispersing.

From all reports and video footage, this cloud was clearly visible for 40 minutes with the smoky trail slowly dissipating over a period of ten minutes (Figures 6 and 9).

3.3 The sonic boom from the terminal blast

Reports show that the sonic boom following the detonation was heard as far south as Bulls (175°23E, 40°11S) approximately 100 km distant, and as far north as Turangi (175°48E, 39°00S), 120 km distant (Figure 10).

Observers have variously described the sonic boom as loud artillery gunfire, hissing, back firing, and rumbling thunder. There appear to have been three major explosions with the third explosion the loudest and deepest. All reports state that the sound lasted well over 50 seconds.

Nigel Fysse from the Upper Whanganui River, Kauarapaoa, independently confirmed the written observational reports by supplying videotaped footage (with audio) of the terminal blast cloud, which verifies the three reported explosions from the detonation (Figure 10).

From the seismic data obtained it has been estimated that the detonation had a minimum source energy equivalent 300 tonnes of TNT (Manville et al., 2004).

3.4 Physical effects of the terminal blast

Observers from the Waverley/Waitotara and Maxwell areas of Taranaki felt the effects of the detonation. This included an observer 70 km north of Waitotara and four observers 40 km southeast of Maxwell.

The areas where observers reported feeling the physical effects of the terminal blast have been split into four locations around Taranaki, and are just a small sample of the reports and observations received from the Taranaki area.

- **Waverley.** Residents reported their homes shaking, with an observer stating: ‘I could feel the ground shake under the house in a semi-circular path on the southern end of my home.’

Figure 6 – Video stills courtesy of Mr and Mrs Patash. Taken from the Upper Takaka region at the northern end of South Island (Figure 9).

One kilometer northwest of Waverley, local farmer Grant Hughes was riding a quad bike on his dairy farm. He reported: ‘I saw a bright flash which was followed by a huge explosion. The pressure waves from the explosion physically forced me hard down onto the bike, not once but twice. I have never known or felt anything like it.’

Two observers 5 km north of Waverley reported a very smoky and sulfurous odor just after the explosion.

There were also reports of earth tremors, heat hazes going through trees and terrified animals.

- **Waitotara.** The most detailed of these observations came from a local resident, who reported: ‘The power lines in the street were swaying, the ground and shed shook like it would in an earthquake. The beautiful clear day had vanished and the sky had become very white. The air was extremely warm and this warmth lasted for approximately ten minutes before returning to normal.’

  He also stated that his partner saw the curtains being sucked out an open window and that they were both very scared and too embarrassed to come forward with information until an explanation had been given for what they had experienced.

  Other Waitotara reports included frightened animals, and one observer reported he felt what he could only describe as ‘vertical pressure shock waves’.

- **Maxwell.** Observers also reported ground movement, with the ‘ground lifting like waves’. Heat hazes were reported from the direction of the terminal blast cloud.

- **Mowhanau Beach.** The following report was received from a local couple who regularly walk Mowhanau beach 5 km southeast of Maxwell (174°54S, 39°53E):

  ‘We were walking along the north end of the beach on Saturday July 10th. We saw a very large number of cockles, (i.e. bivalves) they were all at the water’s edge, and all were alive. We have never seen this before . . . this is unheard of (Figure 11).’

- **Wanganui.** Reports were consistent with one another, with one observer stating:

  ‘My floors were moving in a flowing motion, almost like being in a ship going over a wave.’

  An eyewitness describes what he felt while playing golf at the Castlecliff Golf Club: ‘The explosion felt like a vertical impulse earthquake and I could feel the ground vibrate below my feet while standing on the golf course.’

3.5 Time and location of the terminal blast

On 1999 July 7, at $04^{\rm h}14^{\rm m}42^{\rm s}$ UT, the Defense Support Programme (DSP) (a space-based component of the United States of America early warning missile system) detected the bolide responsible for the Taranaki Fireball on detonation[1] (Simmons & Creswell, 2000). Their geosynchronous satellites detected a triple peaked intensity signal, confirming the observer’s reports of three explosions. Dr Dee W. Pack from Space and Environment Technology Centre stated in email correspondence, ‘This is not inconsistent with the audio recording.’ (Pack, 1999).

The final location of the fireball’s detonation has been modeled on the arrival times of the sonic boom. An explosive point source location has been calculated at 174°45E, 39°45S based on seismic data (Manville et al., 2004) (Figure 11).

[1] The information regarding this event, re, the flight path, altitude, and azimuth of the bolide, still remains classified with D.S.P even after several attempts were made to gain the information required for this report.

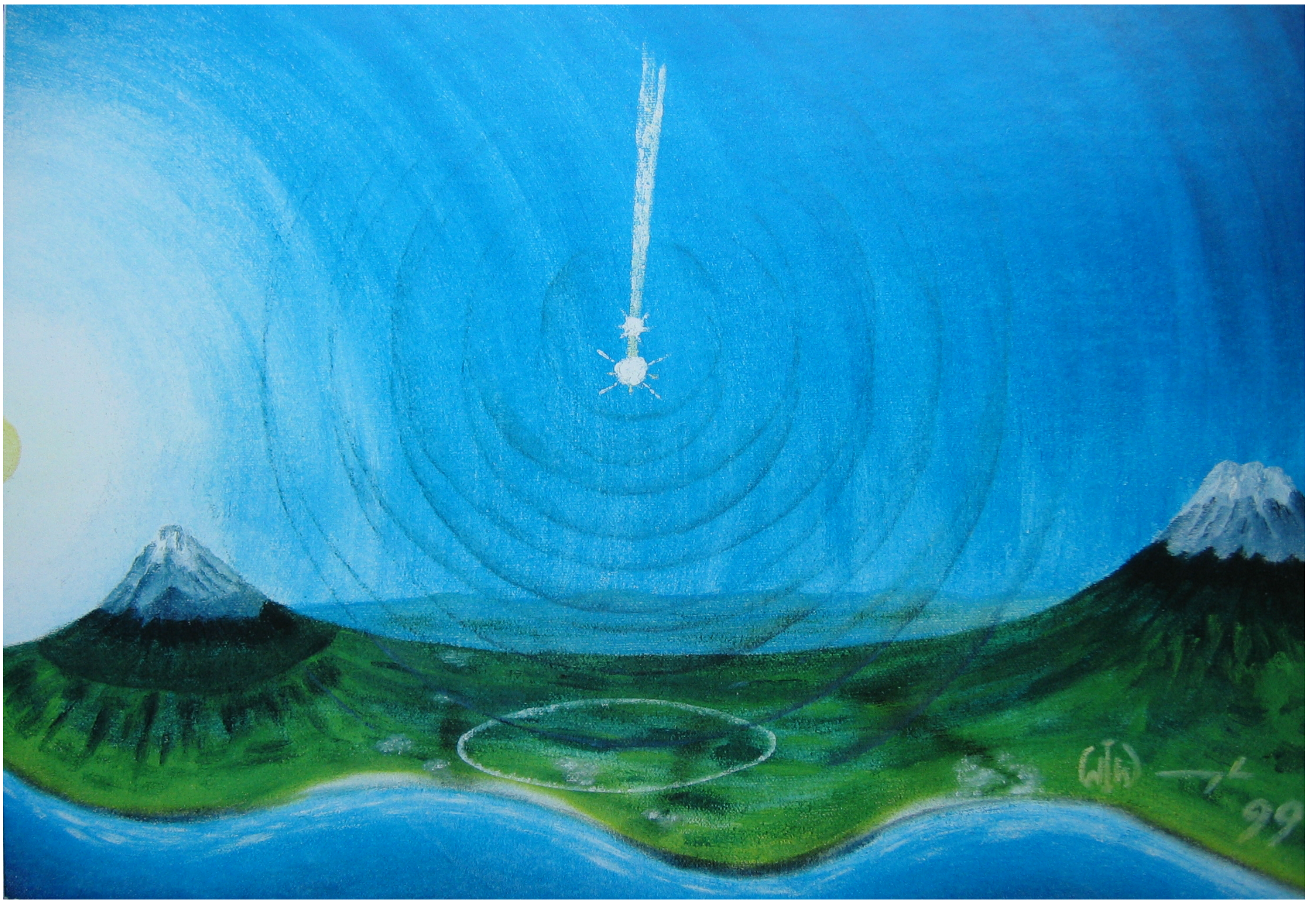

Figure 7 – Artist's impression of the shock and sound waves between Mt Taranaki (left) and Mt Ruapehu, by Ivon Warmington, Wanganui.

3.6 Height of the terminal blast

Using eyewitness reports from several of the more accurate observations, the detonation of the bolide was roughly placed in the mid stratosphere, approximately 32 km above Earth's surface (Christie, 1999).

Plotting the elevation angles from the most southern and northern observations; Ruatangata, Northland (174°17E, 35°40S) and Rangitata River, South Island (171°31E, 44°11S), enabled an approximate height for the detonation to be obtained (Figure 8).

Geological and Nuclear Science New Zealand Ltd have independently confirmed this elevation using their seismic data (Manville et al., 2004).

4 Discussion

The observation of hundreds of live infaunal cockles (*Austrovenus stutchburyi*) on the north end of Mowhanau beach, 54 km south east of the fireball's detonation point three days after the event may have been a direct result of the detonation of the bolide.

Marine biologist Dr. Katrin Berkenbusch from Portobello Marine Laboratory, University of Otago stated in personal correspondence, 'These animals are very sensitive to pressure changes and other habitat disturbances. Further research and experimentation should be conducted to confirm this interesting observation.' (Berkenbusch, 2005).

Information pertaining to possible algae bloom or tidal effects in the Mowhanau and surrounding coastal areas in 1999 July was sought by the author to explain other reasons for this disturbance. However, the University of Auckland's Marine Laboratory was unable to support any conclusive evidence for possible algae bloom effects for the bivalve observations.

As noted earlier, important information regarding the exact entry point into the atmosphere including the bolide's flight path, speed, altitude and azimuth still remains classified with The Aerospace Corporation from Space and Environment Technology Centre in Los Angeles. It is hoped this information may be available in the near future to refine the scientific results for this event.

New Zealand's astronomical history is littered with eyewitness fireball and meteor events. Almost all of these have taken place under the cover of darkness, guaranteeing a flurry of eyewitness reports. The scarcity of documented daylight fireball reports in New Zealand has made obtaining past data extremely difficult. The one exception was a daylight fireball in 1996 January. This event produced 33 written eyewitness reports to Stardome Observatory but no reported or documented evidence of atmospheric detonations were recorded in any of the eyewitness observations (Muzyka & Dunlop, 1996).

R. A. McIntosh, an experienced New Zealand amateur astronomer, was an active meteor observer in the 1930s. His distinguished record of meteoric display reports, including fireball events, can be found scattered among many of the world's astronomical journals.

The most detailed of these was an evening fireball in May 1933. At the time, this event was stated by McIntosh to be 'the most remarkable meteoric display on record in this country'. This event produced 48 eyewitness reports and from these, no atmospheric detonation effects were reported (McIntosh, 1934).

In 1929 McIntosh reported a detonating twilight fireball to the British Astronomical Association. This event produced 50 eyewitness reports from around Christchurch in the South Island and of these, 17 witnesses reported audible evidence. McIntosh stated in his paper that he 'regretted the accuracy of the observations were such, that a careful study of the audibility of the fireball was unwarranted' (McIntosh, 1930).

5 Conclusion

The Taranaki Fireball is the only fireball to have been observed and reported by numerous witnesses across the North and South Islands of New Zealand. The event was extremely valuable to the scientific community as it was also captured on amateur video and audiotape from two independent locations, on seismic records from the Geological and Nuclear Sciences Ltd, and by the Defense Support Programme of the United States of America.

From the reports received and logged, it is estimated that the bolide entered the Earth's atmosphere at a highly inclined angle northeast of the North Island of New Zealand. An accurate speed has not been obtained; however, on average, meteors and fireballs move through the atmosphere at speeds up to and greater than 15 km/s.

The fireball detonated in a series of three explosions at $04^h14^m42^s$ UT on 1999 July 7, at a height of approximately 32 km above the point location $174\overset{\circ}{.}45$E, $39\overset{\circ}{.}45$S, close to the towns of Hawera and Waverley in the Taranaki Region. The detonation is estimated to have had a minimum source energy equivalent 300 tonnes of TNT. Comparisons with the only other three recorded fireball events (1996, 1933 and 1929) show that the Taranaki Fireball of 1999 July was an extraordinary and rare event and was also the brightest and most comprehensively observed daylight fireball in New Zealand's known astronomical history.

Acknowledgments

Dr Ian Griffin, Dr Grant Christie, and Jim Robinson, Stardome Observatory. Dr Terry Web and Dr Vernon Manville, Geological and Nuclear Sciences Ltd. Dr Katrin Berkenbusch, Portobello Marine Laboratory, University of Otago. John Field, Carter Observatory. John McCosh, Wanganui Astronomical Society.

The author gratefully acknowledges the New Zealand residents who supplied observations, photographs, video/audio tape recordings, and paintings of the 1999 Taranaki Daylight Fireball. These observations were greatly appreciated. This report and case study could not have been made without them.

Addendum

On 2006 September 12 at approximately 14^h55^m (02^h55^m UT), and at the time of finalising this report, a daylight fireball detonated over the populated city of Christchurch in the Canterbury area of the South Island of New Zealand.

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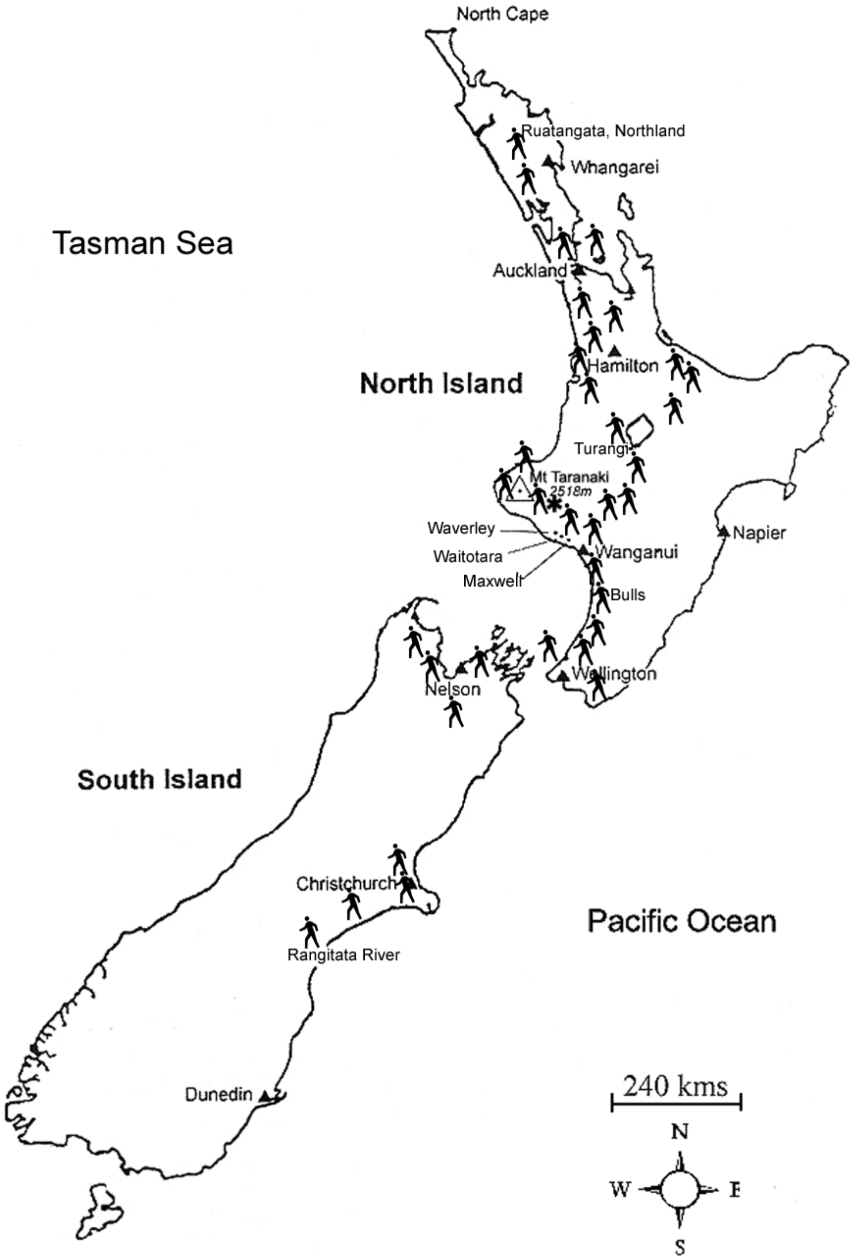

Figure 8 – Locations of Eyewitnesses.

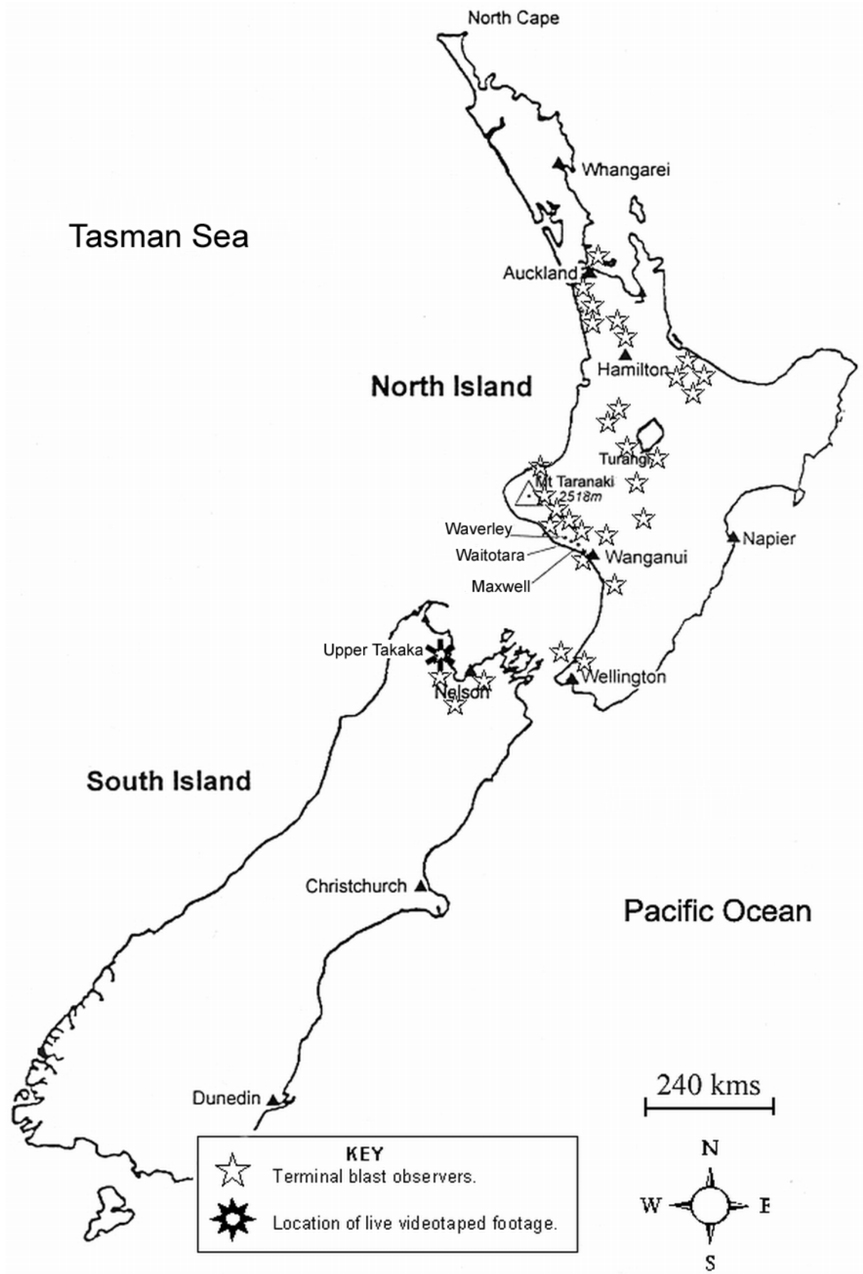

Figure 9 – Locations of Observers to the Terminal Blast.

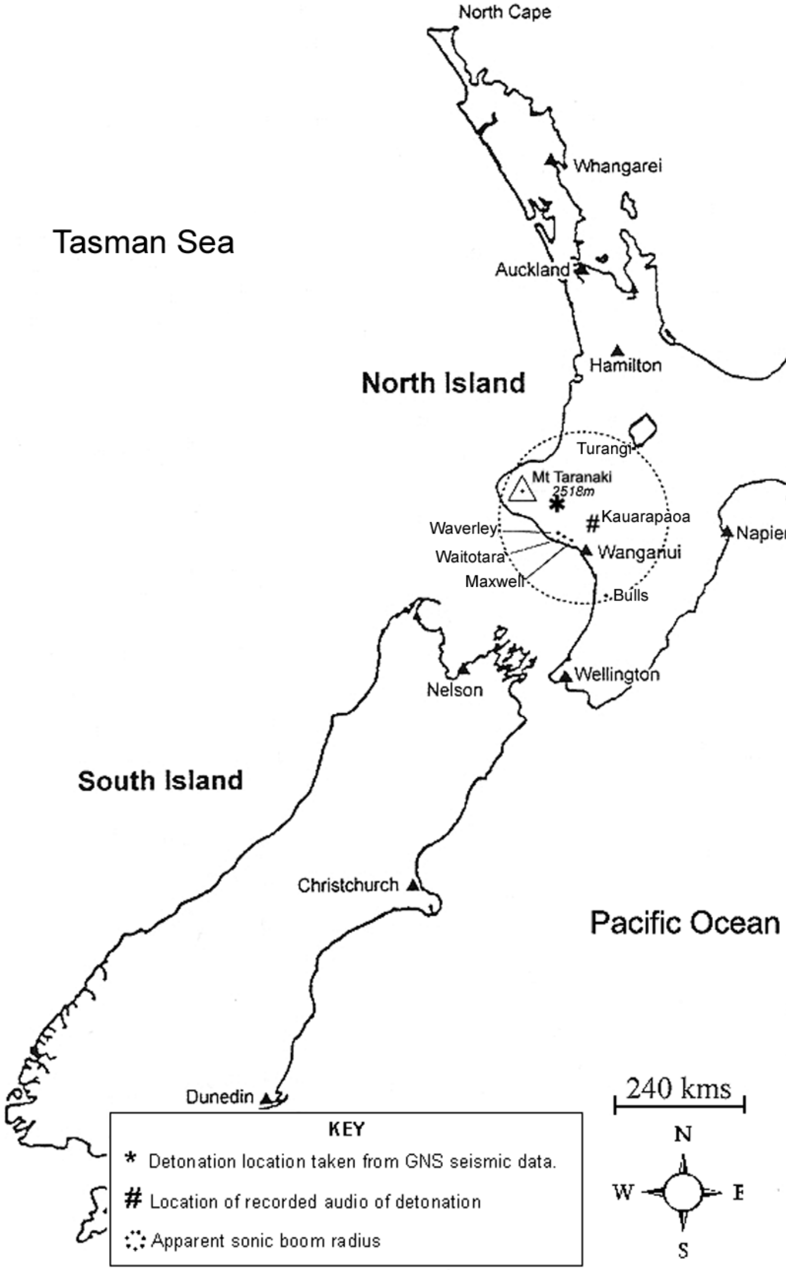

Figure 10 – Apparent Radius of the Sonic Boom.

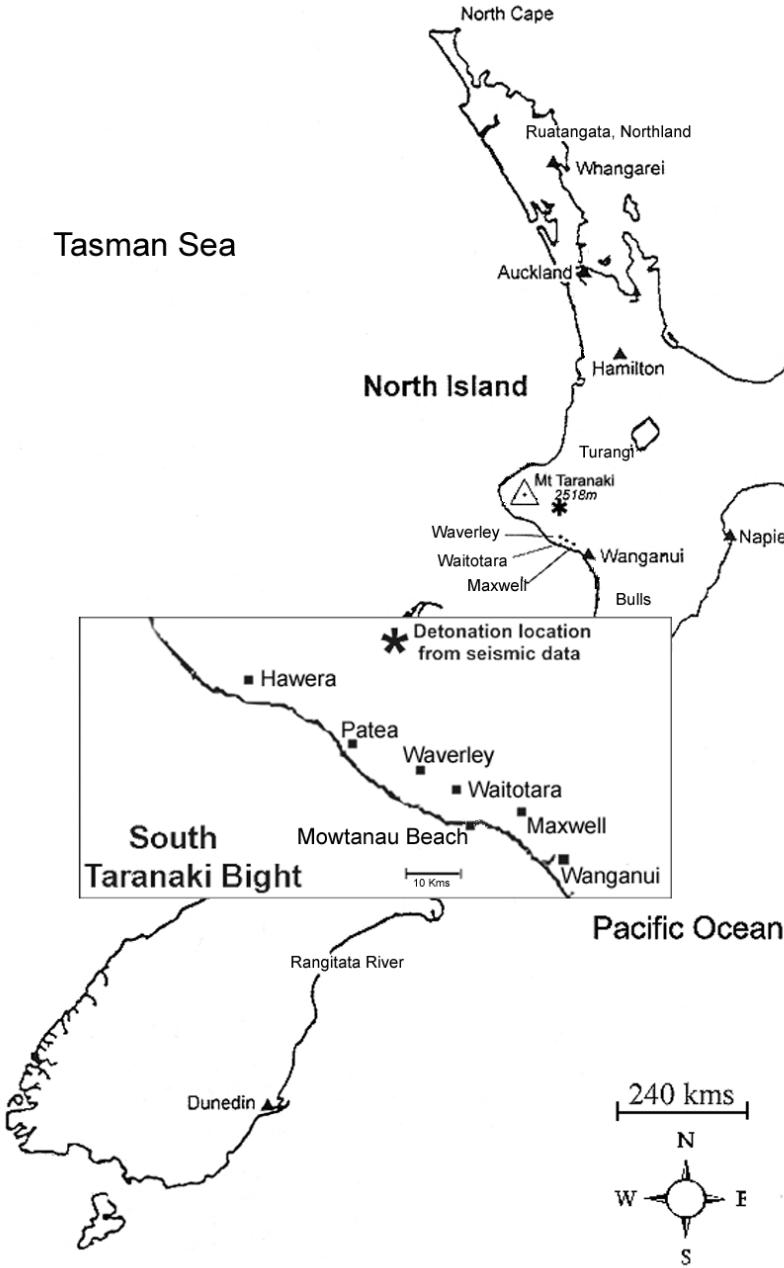

Figure 11 – South Taranaki Bight.

History

Meteor Beliefs Project: an introduction to the Hallowe'en Special

Alastair McBeath[1]

Some notes on the origins of Hallowe'en are given, to introduce a set of articles largely relating to beliefs in meteors as portents of birth or death. A discussion of Classical 'goat' and 'torch' meteors is also presented, with some brief comments leading into the three papers.

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1 Introduction

As the Meteor Beliefs Project has progressed, it has sometimes been possible to draw a number of related themes or items together in a single article, or a suite of articles. On this occasion, a number of aspects of folklore linking meteors with death and birth called to mind the possibility of presenting a special group of articles in the October Journal, in honour of Hallowe'en, the time when the boundaries between life and death have long been thought at their thinnest. This introductory piece adds some notes on the ancient 'Summer's End' festival which Hallowe'en is based on, plus some remarks about 'goat' and 'torch' meteors, which also fit within such a Hallowe'en scheme. See also the detailed review of meteor beliefs from Belarus in the previous issue (Avilin, 2006).

2 Samain and Hallowe'en

All Hallows Eve, shortened to Hallowe'en, is the Christian replacement for a more ancient European festival once held on October 31 to November 1 (the latter now All Saints' Day in Christian custom), marking both the end of summer, and the start of a new year. All Saints' Day was introduced by Pope Boniface IV in the 7th century AD to stamp out the previous celebration at this time, the pagan festival of the dead, Samain.

'Samain' is the Old Irish spelling of a similar word found in the Scottish Gaelic, Irish and Manx languages. It is derived from *sam* = 'summer' and *fuin* = 'end'. The Manx variant, the most English-phonetic, 'Sauin', is a better guide to the pronunciation, however. It was the most important of the four seasonal feasts in Celtic traditions, a time when Julius Caesar noted the Gaulish death-god was particularly venerated. The bronze calendar-tablets found at Coligny, France, in 1897, dating to the 1st century AD, indicated that Samain marked the start of the Celtic new year, and the beginning of the year's 'dark half'. The 'light half' began on April 30 to May 1, May Eve and May Day, with the Beltaine festival (Manx 'Boaldyn').

Other important elements of the Samain festival which have survived in texts and oral traditions included the lighting of bonfires, a particularly essential aspect, and possibly fertility rites, as Irish and Scottish beliefs held that this was the most favourable time for a woman to become pregnant. It was also a 'dangerous' time, when the borders between the worlds of the living and the dead were down, a time for divination and portents, particularly concerning death and marriage. Parts of this still persist in the modern Hallowe'en, of course.

For more details and the main references, see MacKillop (1998), especially p. 65 'calendar', p. 127 'divination', and pp. 333–334 'Samain'. MacKillop provides a viably crisp definition of 'Celtic', as including material preserved by written or verbal means in the Irish, Scottish Gaelic, Manx, Welsh, Cornish or Breton languages, incidentally.

3 Of Goats and Torches

Both these terms were used anciently to describe notable meteors, and the names fit nicely with the overall 'Hallowe'en' theme here. The inclusion of torches is obvious enough, given the central importance of light, dark, and fires at this time for the Celtic peoples. Animal horns, including those of goats, have been found in archaeological contexts, implying a ceremonial use of some sort by these same people. Later Christian usage added such animal horns to numerous demonic beings, as an easy way to recognise the agents of evil, which became associated with Hallowe'en.

Aristotle (384–322 BC) seems to have been the first to use the terms 'torches' and 'goats' in a meteoric sense, though he was probably doing no more than recording some contemporary folk-names in doing so:

...let us now explain what is the cause of the appearance of burning flames in the sky, of shooting stars, and of what some people call 'torches' and 'goats'. All these phenomena are the same thing and due to the same cause, and only differ in degree. ('Meteorologica' I.IV.341b, 1–5; (Lee, 1952, pp. 28–29))

He continued by suggesting these differences were due to the position and quantity of the flammable material he imagined was present in the high atmosphere:

If it extends both lengthwise and breadthwise we often see a burning flame of the kind one sees where stubble is being burnt on ploughland: if it extends lengthwise only, then we see the so-called torches and goats and shooting stars. When it throws off sparks as it burns (which happens when small portions of matter catch fire at the side but in connexion with the main body) it is

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NASA-ADS bibcode 2006JIMO...34..143M

called a goat: when this characteristic is absent it is called a torch: and if the parts of the exhalation are broken up small and scattered in many directions both vertically and horizontally, then what are commonly thought to be shooting stars are produced. (Ibid, 25–35; (op. cit., pp. 30–33))

This all seems straightforward, and for the meteors at least was most likely based on actual observations. Torches and goats were especially bright meteors, what we would now consider bright fireballs, the goat type fragmenting severely along part of its path. This fits with other ancient Greek usage of the term 'goat' (= 'aigos') as referring to objects which were hairy or had a fringed edge. It also recalls both the name of the 'Aegospotami' probable meteorite fall of 467 BC (McBeath & Gheorghe, 2005), and the goddess Athene's possession of the tasselled shield 'aegis', along with her own meteoric and possible meteoritic connections (McBeath & Gheorghe, 2004). The exact significance of these points is unclear, but may not be due to mere coincidence.

The later Latin authors Pliny (23–79 AD) and Seneca (writing around 62–65 AD) rather lost themselves over the whole issue. Pliny used both 'torch' and 'goat' as terms for comets, the torch-star comets looking like glowing fiery torches (using the Latin terms *lampades* and *faces*; 'Natural History' II.XXII.90 (Rackham, 1949, pp. 232–233)), while:

There also occur 'Goat comets,' enringed with a sort of cloud resembling hair. (Both loc. cit.)

He then re-used just the lampades-faces-torches form subsequently for bright meteors, of which he suggested:

...there are two kinds: one sort are called lampades, *which means 'torches'* [= faces], *the other* bolides *(missiles)...*

...The difference between them is that 'torches' make long tracks, with their front part glowing, whereas a 'bolis' glows throughout its length, and traces a longer path.

(Both quoted passages: op. cit., XXV.96; op. cit., pp. 238–241)

This classifying description seems a lot less useful than Aristotle's, is not at all clear-cut, and may not have been observationally-based.

Seneca muddied the waters still further in his discussion of fiery meteors:

The fires have many different shapes. Aristotle calls one kind a Goat. If you ask me why, you should first explain to me the reason some are called Kids. ('Naturales Quaestiones' I.1.2; (Corcoran, 1971, pp. 14–15))

Has Seneca muddled himself by thinking of the 'little she-goat' star Capella in the constellation Auriga, and its neighbouring triangle of fainter stars called the Haedi, or Kids? Or is he suggesting the folk-name for some meteors was 'Kids'? No other contemporary or earlier author mentions this, so we are left to guess. Seneca continued:

It will be more approriate to investigate the phenomenon itself rather than to wonder why Aristotle has called a ball of fire a Goat. Actually, that was the shape of a fire which did appear, about the size of the moon, when Paulus was waging war against Perseus. (Both loc. cit.)

The war mentioned occurred in 168 BC, but the goat-meteor text is wonderfully self-contradictory, and unhelpfully vague - was the 'goat-shaped fire' of 168 BC a comet or a meteor, for instance?

Seneca went on ('Naturales Quaestiones' I.1.5; op. cit., pp. 16–17) to list four types of meteors: boards, balls, torches and blazes. 'Boards' recur as meteors with Pliny ('Natural History' II.XXV.96); 'balls' are reasonable enough; 'torches' we know about; but 'blazes' are again both unique to Seneca, and incredibly vague. He later stated (I.1.12; op. cit., pp. 20–21) that torch-meteors had been seen in his own time during daylight, which falls in well with the idea that these were very bright fireballs. Even so, whether Seneca ever observed the night sky seriously, let alone saw any meteors for himself, seems rather doubtful on this evidence.

After this, the 'goatish' meteors largely disappeared, and did not recur in many later works, except where a subsequent author drew heavily on Classical sources, such as the 16th century 'Meteors' text by William Fulke (McBeath & Gheorghe, 2006). The more fiery forms did persist, of course, but perhaps elsewhere the 'goats' transformed themselves into the more aptly-fiery meteor-dragons of succeeding times.

4 Notes on the Hallowe'en Special articles

Two of the three other papers in this collection discuss aspects of folkloric beliefs in a connection between meteors, death and birth, from Romania, Britain, and the Classical world, which latter doubtless influenced the more recent ideas. The concluding piece has a more inventively macabre slant, but still deals with a similar topic, from Coleridge's 'Rime of the Ancient Mariner'.

5 Conclusion

As the Meteor Beliefs Project coordinators have stressed from the outset, we welcome input from anyone with items of meteoric interest to share. If you have found something we have not yet discussed, or new details about topics that have been covered, do please contact us. The Project can only be improved by fresh, positive input.

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Meteor Beliefs Project: Birth and death superstitions associated with meteors in Romanian and British folklore

Andrei Dorian Gheorghe[1], *Roy Watson and Alastair McBeath*[2]

Notes from Romanian and British sources on folk-beliefs are given, linking the appearance of meteors with birth or death.

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1 Introduction

Some short notes and details concerning the link between meteors, and birth and death superstitions, as extracted from references on Romanian and British folklore, are given below. These date back to the 19th century in parts, but must be simply the more recent recorded survivals of longer oral traditions.

2 Romanian beliefs

The meteoric material used here was a small part of the astronomical and atmospheric folklore collected by Ion Ottescu, during a twelve-year programme of research and investigation in the late 19th and early 20th centuries. It was first published by him in 1907. The details he recorded about the peasant beliefs from Romania (excluding the area of Transylvania, which became part of Romania only after the Great War ended in 1918) are both extensive, and largely unparalleled from most other European countries. The following texts and discussion use references to the unpublished English translation ADG and AM prepared in 1998 (Gheorghe & McBeath, 1998b).

In the Romanian peasants' belief, the stars were candles:

...and every man has his own star in the sky. Each man's heavenly candle is set alight at his birth. If that man is an emperor, then his star is great and brilliant, a luceafăr. *If the man is a simple one, his star is small and faint. When the man dies, his star falls from the sky, and his candle is extinguished.* (Op. cit., Chapter 3, p. 36)

Fireballs in the Romanian conception were often known as fiery, draconic creatures, the flying *balaurii*, or *zmeii* in their human and semi-human shapes. Though not always antipathetic as zmeii, in their evil form, they stalked the night, waiting to pounce as meteors on anyone spotted alone outdoors, to disfigure or kill that person. When doing so, they were also called 'lost' or 'travelling' stars, of ill-omen (loc. cit.; see also (Gheorghe & McBeath, 1998a) for more details on the Romanian meteor-dragons).

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3 British traditions

Most of these notes were extracted from the standard text 'A Dictionary of Superstitions' (Opie & Tatem, 1989), page 376, except where stated. The cited sources are as given in that work.

Recorded beliefs in meteors as portents of birth were first dated by Opie & Tatem to 1824, with this comment from Volume II of L. Hawkins' 'Anecdotes', p. 74:

There's a child born when a star shoots: it is supposed to fall over the spot.

Further details were found in Volume VI of the 5th series of 'Notes & Queries' from 1876, p. 506:

In Yorkshire, when folks see shooting stars, they say, 'They are babies' souls coming down from heaven'.

Similar mentions were given from 1923 and 1955, although a variant from Dorset, England in the 1950s suggested the sex of the child was also determined this way:

Children were told that a baby boy was born every time a shooting star fell. (Roud, 2003, p. 407)

On the other side of the coin, beliefs in meteors foretelling death were rather more detailed and extensive. The earliest personal comment from Opie & Tatem, repeated by Roud, was sourced to Addison in the 'Spectator' magazine for March 8, 1711, and though not specifically referring to a death, we wanted to include it for its unintended truism for all meteors watchers:

I have known the shooting of a star spoil a night's rest.

The next comments came from a letter by novelist Elizabeth Gaskell in 1836 (from p. 31 of a compilation of her letters edited by Chapple & Pollard):

A shooting star is unlucky to see. I have a chill in my heart when I see one, as I have often noted them when watching over a sick-bed.

Then in 'Notes & Queries' for 1866 (3rd series, Volume X, p. 25) is the first specific death-portent, where a woman from Huntingdonshire in England described the events leading up to the death of her baby, following a short illness.

I had a warning that it was to go. The night before it was took I was passing your gate, Sir, and a great star fell down from the sky plump before me. It did not go into the ground, but burst about a foot above the road. As soon as I got home I told mother about it, and said it was a warning for someone. She said, 'Perhaps it's for grandfather'. I said, 'May be , mother; but I fear it's for someone nigher'. The next day my poor babe was took. (Roud, loc. cit.; Opie & Tatem, loc. cit., give just the first two sentences.)

Other references of every shooting star predicting a death were given for 1883, 1907 and 1953. That for 1907 from Nottinghamshire, England, is worth expansion here:

I remember that on one occasion, when a shooting star burst with a report, it was said by one present, 'Ah! we shall hear of some big man's death.'

This is unusual, as it referred to the death-portending meteor making an audible noise, something not found elsewhere.

4 Conclusion

Births and deaths generally are as plentiful as visible meteors, judging by the statistics for both, so such a link is not unreasonable in folklore. The greatest wonder is that the Huntingdonshire woman of 1866 was not the one killed, if the meteor really 'burst about a foot [30cm] above the road' in front of her. An interesting re-use of the familiar 'fireball that landed in the next field' folklore motif, certainly.

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Meteor Beliefs Project: Classical beliefs connecting meteors with life and death

Alastair McBeath[1] *and Andrei Dorian Gheorghe*[2]

Details concerning meteors as indicators of life and death, extracted from ancient Greek and Latin sources between the circa 5th century BC to the circa 5th century AD, are presented. Some relevant material concerning souls as resident in stars in a similar vein is given too.

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1 Introduction

Although it is difficult to trace a direct series of connected points over the intervening time, it seems likely that many of the beliefs linking meteors with birth and death discussed in this issue of WGN and the previous one had an ancient origin. Comparable beliefs can be found in the writings of various Classical Greek and Latin authors certainly, as we demonstrate here.

2 Platonic beginnings

Plato (circa 427–347 BC) set out his vision of much of the known cosmos in his 'Timaeus'. Unfortunately from our perspective, he totally ignored comets and meteors, but he did make some relevant comments regarding the stars. Plato had his creator-deity make the soul of the universe and the gods from the purest material, and then used the less pure residue for other tasks:

And when He had compounded the whole He divided it into souls equal in number to the stars, and each several soul He assigned to one star, and setting them each as it were in a chariot He showed them the nature of the Universe, and declared unto them the laws of destiny. ('Timaeus' 41 (Bury, 1929, pp. 90–91))

These 'laws of destiny' meant the souls were forced to inhabit the bodies of men:

And he that has lived his appointed time well shall return again to his abode in his native star, and shall gain a life that is blessed and congenial. ('Timaeus' 42 (op. cit., pp. 90–93))

Failing this 'test' meant the soul was condemned to return to live again, but in a 'lesser' form, that of a woman, and then as a variety of animals if he still did not pass the trial. At this point, we feel it preferable to draw a kindly veil over Plato's further commentary, rather than pick apart the glaring logical and philosophical flaws, of which the beginnings are obvious enough here.

Regardless of how we view the philosophy of these remarks, it is clear where the concept of souls residing in stars, and thus in shooting stars, came from. Whether Plato originated it, or simply recorded the earlier ideas of others, is not known.

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3 The dead transformed

By the 4th century BC, the ancient Greeks had established a widely-held belief that it was possible for some of the dead to be transformed into stars or constellations. In most cases, this applied only to great, often mythological, heroes, such as Castor and Polydeuces (Pollux) as the leading stars in Gemini, for example. Details recorded in Aratus of Soli's 'Phaenomena' (Mair & Mair, 1955; Aratus' dates were circa 315–245 BC) regarding the constellations are definite on this matter, Aratus' work a poem based directly on Eudoxus of Cnidus' (circa 390–337 BC) lost prose text of the same name. Subsequent Greek and Latin authors confirmed such information, albeit not always with the same deceased characters represented by the same stars. It seems probable this reflected a much earlier practice.

4 Plinian common sense

Skipping forward several centuries, Pliny (23–79 AD) strode in with a cool blast of rationalism:

We have stated that the stars are attached to the firmament, not assigned to each of us in the way in which the vulgar believe, and dealt out to mortals with a degree of radiance proportionate to the lot of each, the brightest stars to the rich, the smaller ones to the poor, the dim to those who are worn out; they do not each rise with their own human being, nor indicate by their fall that someone's life is being extinguished. There is no such close alliance between us and the sky that the radiance of the stars there also shares our fate of mortality. ('Natural History' II.VI.28–29 (Rackham, 1949, pp. 186–189))

This neatly encapsulated — and refuted — the beliefs in stars and meteors which in places seem still popularly current.

5 Seneca looks both ways

Around the same time as Pliny, Seneca (whose 'Naturales Quaestiones' was written circa 62–65 AD) seemed to be quite sure he was not certain what to believe. Or was he simply playing Devil's advocate? 'Naturales Quaestiones' I.1.3, with the relevant dates inserted from the modern translator's footnotes (Corcoran, 1971, pp. 14–15), ran:

... we have more than once seen a flaming light in the shape of a huge ball which was then dissipated in mid-flight. We saw a similar prodigy about the time of the death of the deified Augustus [14 AD]. *We saw another at the time when Sejanus was condemned* [31 AD].

And the death of Germanicus was announced by the same sort of sign [G. Caesar, died 19 AD].

Then in I.1.4, Seneca questioned whether the gods would send such advance warnings, or that anyone on Earth could be important enough for the universe to realize they were about to die. Although he entered into a long, disjointed, rambling discussion of portents generally in regard to lightning later ('Naturales Quaestiones' II.32–51), his conclusions were not especially clear, seeming to want to favour a rationalist viewpoint, but apparently not with full conviction.

In regard to meteors, he did have some more definite comments at least:

Yet it is the stupidest thing to suppose that stars actually fall, or jump across, or that anything is taken or rubbed away from them. If this were so, the stars would have perished. Yet every night very many seem to fall and to be carried off in different directions. Still, each star is found in its usual place and its size remains constant. ('Naturales Quaestiones' I.1.9–10 (Corcoran, 1971, pp. 18–20))

6 Plutarch's prognosticators

Tucked away in Plutarch's 'Life of Agis' (Clough, 1910, pp. 90–91) is a curiosity regarding meteors, which, if not strictly related to death, was related to the deposition of a king, a form of, apparently temporary, political 'death'. A group of officials from Sparta in Greece, the 'ephors', would go out on a cloudless, moonless night, every ninth year, to 'observe the sign'. They would sit together silently, watching the sky, in archetypal meteor watching mode:

And if they chance to see the shooting of a star, they presently pronounce their king guilty of some offence against the gods, and thereupon he is immediately suspended from all exercise of regal power, till he is relieved by an oracle from Delphi or Olympia.

Given their choice of observing night, one assumes the Spartan kings had to undergo this ritual every ninth year without fail, though it is far from clear how genuine this tale was. Plutarch lived around 46–120 AD, yet the specific example he cited concerned the Spartan King Leonidas, who was killed defending the pass at Thermopylae against the Persians in August 480 BC. Plutarch had Leonidas deposed, and his brother Cleombrotus made king in his stead. However, Herodotus (circa 480–425 BC), writing a great deal closer in time to the events, had Leonidas succeed to the throne after the deaths of his two elder brothers, while his younger brother Cleombrotus was never mentioned as being king during Leonidas' brief reign (a few months at most, scarcely enough time to become king, be deposed, and reinstated as king after receiving a favourable oracle from Delphi or Olympia). See Herodotus' 'Histories' VII.204–225 for details.

7 Full circle with Claudian

Three of Claudian's texts from the late 4th century AD have some relevant items. 'The Third Consulship of Honorius: Panegyric' (VII) from 396 AD contained the following passage, regarding the death of Emperor Theodosius I in 395:

He spake no more, but still in human form clove a furrow of light through the clouds; he passes to Luna's globe, leaves Mercury's threshold and hastens to the gentle airs of Venus. Hence he traverses Phoebus' path, Mars' baleful fires and Jupiter's quiet quarters, and stands upon the very crown of the sky, cold Saturn's frozen zone. Heaven's fabric opens, unbidden the shining doors swing back. Boötes prepares a place in the vault of the northern sky, sword-girt Orion unbars the portals of the south; they offer welcome to the new star, uncertain each in turn to what region he will betake himself, what constellation he will grace with his presence, or in what quarter he will elect to shine alone. (Lines 162–174; (Platnauer, 1922a, pp. 282–283))

'The Fourth Consulship of Honorius' (VIII) of 398 AD, had a description of a new star easily seen at midday, which Claudian claimed had appeared as one of a series of omens around the time of Honorius' birth, in lines 182–191 (op. cit., pp. 300–301). This star was not stated as meteoric or in motion, however.

Finally, 'On Stilicho's Consulship, II' from 400 AD, lines 424–440, described an incredibly distant, unbelievably old cavern, both the cradle and tomb of time. A great serpent, representative of cyclicity and infinity, endlessly gnawed its tail, encircling the cave. In front of the cave-mouth sat the ancient yet ever-youthful female being Nature, guarding the entrance, while spirits flitted and thronged around her, and:

A venerable old man writes down immutable laws: he fixes the number of stars in each constellation, and causes these to move and those to be at rest, whereby everything lives or dies by pre-ordained laws. (Lines 433–436; (Platnauer, 1922b, pp. 34–35))

8 Conclusion

Thus with Claudian's hoary cavern and its immortal inhabitants, we come back to where we began with Plato, about 800 years earlier. Just chasing meteors all that time?

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Meteor Beliefs Project: Notes from Coleridge and Doré

Alastair McBeath [1]

Some meteorically-relevant lines from Coleridge's poem 'The Rime of the Ancient Mariner' are discussed, presented with three of Doré's engraved illustrations to the poem, by way of concluding this Meteor Beliefs Project Hallowe'en Special.

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1 Introduction

Samuel Taylor Coleridge (1772–1834) was an influential English poet, critic and radical thinker, who attempted, through his political and philosophical writings and public lectures, to reform the English way of thought. He inhabited the same time as William Blake, whose meteorically-linked works have been discussed in WGN before (McBeath, 2004). His prolific early writings were notable for their often macabre cast, from the period when Gothic literature was at its height. Persistent severe ill-health led to his addiction to the pain-reliever opium, over which he later gained some control, but which he was never entirely freed from, and he struggled financially throughout his life. It is Coleridge's poem 'The Rime of the Ancient Mariner', and some of its later illustrations by Gustave Doré, that is the subject here. Coleridge began the poem in late 1797, and it was first published the following year, but it is the revised version of 1817 which is best-known, and that is the one cited below, from (Jackson, 2000, pp. 48–68, and notes on p. 701). Jackson (op. cit.) also yielded most of these biographical notes.

Coleridge's 'Ancient Mariner' has proven an attractive, imaginative subject for a number of artists over the years, but perhaps the best-known is the great French illustrator, painter and sculptor, Gustave-Paul Doré (1832–1883). Doré was a precocious illustrator, producing deliberate caricatures of his parents by the time he was five, and entire series' of drawings to accompany published texts he had read by 1838. He was largely self-taught as an artist, relying on his excellent natural talents and powers of observation. He supplemented a comfortable private family income with a voluminous life's production of artworks, but he always remained artistically independent. He was a superb draughtsman and painter, and a great visionary, so it is unsurprising he was moved to illustrate the Bible, and other imaginative, mythological and fantastic works by poets such as Dante, Spenser, Milton, Byron, and of course Coleridge, whose 'Ancient Mariner' he prepared engravings for in 1875. The nature of his *oeuvre* led to him being often heavily criticised by those of the Realist school in his homeland, which upset him considerably, though his works were far more favourably received elsewhere, such as in Britain. The death of his mother in 1881 was a severe blow he never recovered from, and he died unhappily early of a heart attack just two years later. (Doré's biography here was mostly derived from (Turner, 1998, pp. 169–171).)

2 'The Rime of the Ancient Mariner'

The central plot of Coleridge's 'Ancient Mariner' revolved around the punishment and eventual partial salvation of the captain of a sailing ship, who, on an unaccountable whim, shot and killed an albatross, a bird of good omen. Hallowe'en is as suitable a time as any to read, or re-read, the whole poem, essential to supplement the short extracts used here.

By the time we join the work, in Part V, the albatross is long dead, as is the captain's crew. Part of the captain's punishment is that he is not allowed to die with the rest. On board his long-becalmed vessel, the captain has managed a brief, silent prayer, allowing the end of his punishment to begin. It has recently rained for the first time in weeks, and the captain has heard a roaring wind. This sound, though not the wind itself, has shaken the sails, now so old and thin as to be virtually transparent. Then:

> The upper air burst into life!
> And a hundred fire-flags sheen,
> To and fro they were hurried about!
> And to and fro, and in and out,
> The wan stars danced between.

(Lines 313–317; (Jackson, 2000, p. 58))

Celestial meteors like those elaborated here as darting fiery flags, were classically perceived as foretellers of strong winds, but Coleridge has also used them to indicate a change in the mariner's fortunes. The change starts in Gothic style:

> And the coming wind did roar more loud,
> And the sails did sigh like sedge;
> And the rain poured down from one black
> cloud;
> The Moon was at its edge.
>
> The thick black cloud was cleft, and still
> The Moon was at its side:
> Like waters shot from some high crag,
> The lightning fell with never a jag,
> A river steep and wide.

(Lines 318–326; (op. cit., pp. 58–59))

The lightning falling straight down in a linear path is both distinctively portentous, and distinctly meteoric, especially given the folkloric link between meteors and lightning we have found in previous examinations. That

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Figure 1 – Some of Doré's engravings from the Rime of the Ancient Mariner. Left to right: (a) spirits marked as such with stars on their heads; (b) Death and Life-in-death gamble for the crew; (c) angelic spirits crossing the ocean.

all this was begun with the meteors dancing between the stars is not coincidental, as they, and their subsequent agents on this ghastly night, bring something else to the ship:

> The loud wind never reached the ship,
> Yet now the ship moved on!
> Beneath the lightning and the moon
> The dead men gave a groan.
>
> They groaned, they stirred, they all uprose,
> Nor spake, nor moved their eyes;
> It had been strange, even in a dream,
> To have seen those dead men rise.

(Lines 327–334; (op. cit., p. 59))

So the meteoric fire-flags and jag-less lightning have brought neither true life, nor death, as was discussed earlier in this issue, but a kind of half-life to the dead, very fitting for Hallowe'en. Even now, this was not the whole story, as Coleridge's marginal notes beside lines 346–350 explained the corpses' possession was:

'...not by the souls of the men, nor by demons of earth or middle air, but by a blessed troop of angelic spirits, sent down by the invocation of the guardian saint' (loc. cit.).

Later still, in lines 490–495 of Part VI, these angelic spirits released the corpses, and appeared as seraph-men, each one a wonderful light, reaffirming the shining meteor-angel link found elsewhere.

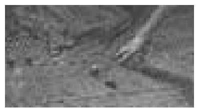
3 Doré's angels

As Doré was fascinated by angels, and frequently included winged angelic forms in his compositions, it is not hard to see the attraction for him of Coleridge's conception. The closest he came to depicting the angelic spirits as meteors is shown in Figure 1c, where a distinct comet hovers over the head of one of the butterfly-winged angels, in turn above the turbulent sea.

Doré typically used stars over the heads of other figures, to indicate that they were spirits or angels in his 'Ancient Mariner' illustrations. Figure 1a gives one of the clearest such depictions, illustrating Part II, lines 127–134 of the poem, where 'death-fires' (sometimes also called 'meteors', but of the Will O'Wisp or St Elmo's fire kind) danced over the sea, as the — here bat-winged — spirit from the land of ice and snow approached, bringing vengeance to the mariner and his crew.

4 Conclusion

On a suitably macabre note, Figure 1b shows Doré's illustration for Part III, lines 187–198 of the 'Ancient Mariner', where Death and Life-in-Death approached the mariner's vessel aboard their own ghost-ship hulk, playing dice for the mariner and his crew. While it has no clear meteoric link, given that the Meteor Beliefs Project articles in this issue have dealt with the folkloric connection between life, death and meteors for Hallowe'en, it seemed an apt place to halt.



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