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- 0038 Kozlov, B N, Maximum energy liberation by ball lightning from **Sov.Phys.Dokl.**23(11) Jan 1978 [V-J Ballester Olmos]
- 0039 Havik, Leif, More about the Hessdalen phenomena [L.H.]
- 0040 Ignis fatuus in Gorbitz forest, in Milner, **Gallery of Nature** ca 1860. [VJBO]
- 0041 Report by Mrs Domenica Falcione [Dennis Stacy]
- 0042 Lights in Carnarvonshire, 1875 [J&C Bord]
- 0043 La 'boule de feu' du Brest-Paris from **Phénomènes Spatiaux** no 2, June 1969 [J Sider / C Maugé]
- 0044 Bauer, N W A mystery unsolved - the story of the Min Min light from **Royal Geographical Society of Australia Bulletin** 17 : 1 (Jan 1982) [Mark Moravec]
- 0045 Crew, E W, Meteorological flying objects from **Quarterly Journal of the Royal Astronomical Society** 21 (1980) [Thierry Pinvidic]
- 0046 Baratoux, M, Sur une observation de 'foudre en boule' faite en avion, from **La Météorologie** 4th series no 28 (Oct-Dec 1952) [TP]
- 0047 'Llowarch', Those lights in the sky, from **Cambrian News** 19.9.1986 [J&CB]
- 0048 Marmontel, M., Effets de tonnerre, from **Nouveaux choix de pièces tirées des anciens Mercures** etc, tome xxv, 1759 [Pierre Lagrange]
- 0049 Sibour, Count L de, The existence of luminous birds, from **Knowledge**, September 1913 [Dave Clarke]
- 0050 Liddel, Urner, Phantasmagoria, from **Journal of the Optical Society of America** vol 43 no 4, 1953 [TP]
- 0051 McGregor, A A, Phantom lights, from **The ghost book** [Bob Skinner]
- 0052 Gurney, J H, Ornithological report for Norfolk (1907) from **The Zoologist** [DC]
- 0053 Lagarde, F, Une chasse à la palombe mouvementée au Col d'Aspin, from **Lumières dans la nuit** 93 (1968)[JS]
- 0054 The bizarre story of a lightning strike from **Science et vie** (1981) [TP]
- 0055 Museum of the Big Bend, **Marfa Lights** [DS]

- 0056 Standler, R B, How to report ball lightning, from **Weatherwise**, August 1972 [VJBO]
- 0057 More ball lightning incidents from **Journal of Meteorology** vol 10 no 97 (March 1985) [J&CB]
- 0058 Smirnov, B M, Ball lightning model, from **Sov.Phys.Tech.Phys.** vol 22 no 4 (April 1977) [VJBO]
- 0059 Huntington, J, More ball lightning reports, from **Journal of Meteorology** 11.149 (1986) [William Corliss]
- 0060 Piekos, Hillard J, personal experience
- 0061 'Llowarch', A mine of experience, from **Cambrian News**, 14.11.1986 [J&CB]
- 0062 Shilton, Pam, The Min Min light from **Journal of Meteorology** vol 8 (1983) [VJBO]
- 0063 Bailey, B H, Ball lightning strikes twice from **Weather** vol 39 no 9 (Sep 1984) [VJBO]

Comments on bol 0033 and 0036 [Claude Maugé]

Index to Clarke & Oldroyd, **Spooklights**, compiled by Nigel Watson

bol 0038

Maximum energy liberation by ball lightning

B. N. Kozlov

(Presented by Academician Yu. B. Khariton, July 27, 1977).
(Submitted April 26, 1977)

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To select the correct theory of ball lightning it is important to determine the maximum quantity of energy, by means of test data, which ball lightning is capable of liberating. Reliance here should be on the largest possible number of independent facts in order to eliminate various random errors of observation. The maximum quantity of energy which ball lightning is capable of liberating can be determined, in particular, by using the described facts of log destruction by ball lightning. Cases are known of the shattering of main topmasts (Ref. 1, p. 18) and of the trunk of a large oak (Ref. 1, p. 68) into slivers, of piles projecting from water (Ref. 2, p. 252), of the shredding of the 25 cm trunk of a vigorous acacia (Ref. 3, p. 57). The nature of the action of ball lightning on wood is identical in all the cases mentioned, and the mass of wood destroyed is of the same order; hence, a single computational analysis of the energy liberation can be performed. Let us note that the destruction of logs was of volume nature in all cases since the wood was shattered into separate fibers or slivers and the energy liberation analysis⁴ for the destruction of the pile is equally applicable to other analogous cases.

A calculation error, underestimating the actual energy liberation a thousandfold, is contained in the specific computation.⁴ This is easily seen by substituting the magnitudes of the formulas presented in Ref. 4 into Eq. (3) in the same paper. According to the revised computation, the energy liberation by ball lightning is 130 MJ. This deduction relies on the simplifying physical assumption that steam under the conditions considered can be described by the equation of state of an ideal gas. More detailed computations were performed by using the real equation of state of a steam-water mixture, where the possible values of the wood parameters (porosity, moisture, spe-

cific heat, strength) were varied. The magnitude of the energy liberated by ball lightning is found to be in the range 10-200 MJ for all allowable values of the wood parameters. The quantity 130 MJ given by the revised computation⁴ indeed falls into this range. Therefore, the maximum energy which ball lightning is capable of liberating is considerably greater than one megajoule, which agrees with the results obtained by facts of a different kind: 11 MJ (Ref. 1, p. 102), 4000 MJ (Ref. 1, p. 107), 8.4 MJ (Ref. 5, p. 59), 3.6-14 MJ (Ref. 6, p. 68), 5 MJ (Ref. 7, p. 84), 4-10 MJ (Ref. 8, p. 108).

Therefore, the results based on an analysis of the nature of the appearance of ball lightning by different authors consistently indicate that the maximum energy which ball lightning is capable of liberating is much larger than 1 MJ.

Meanwhile, ball lightning soaring freely in the atmosphere without interacting with compact bodies will liberate 1-100 W power,¹⁻³ and from 1 J-10 kJ total energy within its whole 1-100 sec lifetime. The energy liberation is essentially different not only in magnitude but also in shape under different conditions (mechanical, thermal, electrical, etc.¹⁻³), a fact which a correct theory of ball lightning should explain.

According to relaxation theory¹⁰ the energy of ball lightning can be liberated in all the forms being observed. It is a maximum when the ball lightning interacts with bodies having an electrical resistivity equal to the wave resistance of the energy supply track, i.e., ~300-500 Ω. In this case, the theoretical magnitude of the energy is ~500 MJ (according to approximate computations). The meeting between ball lightning and a body of optimal electrical resistivity is of low probability; hence the energy liberation of ball lightning is usually considerably less than the maximum possible, but it frequently reaches the megajoule range, as has been observed repeatedly.

¹S. Singer, Nature of Ball Lightning [Russian translation], Mir, Moscow (1973).

²A. E. Covington, Nature 226, 252 (1970).

³M. T. Dmitriev, Priroda, No. 6, 50 (1971).

⁴P. D. Zimmerman, Nature 228, 853 (1970).

⁵J. D. Barry, Priroda, No. 5, 54 (1969).

⁶R. A. Leonov, Riddle of Ball Lightning [in Russian], Nauka, Moscow (1965).

⁷G. S. Teletov, Priroda, No. 9, 84 (1966).

⁸H. W. Lewis, Sci. Am. 208, 106 (1963).

⁹R. C. Jennison, Nature 224, 859 (1969).

¹⁰B. N. Kozlov, Dokl. Akad. Nauk SSSR 221, 802 (1975) [Sov. Phys. Dokl. 20, 261 (1975)]; 224, 10 (1975).

Translated by Morris D. Friedman

[V=J. BALLESTER OLMOs

bol 0039

JAN. 14th. 1987

POLIDE.DO

MORE ABOUT THE HESSDALEN PHENOMENAS.

As one could read in the first edition of Bolide, Mr. Erling Strand wrote some words about the sightings in Hessdalen, in Norway. The Project Hessdalen Part Three, which was to be held in January 1987, was cancelled. The reason for that, was the very few reported sightings. Then one decided to hold a project in Dalarna in Sweden, from where there were some more reports.

Meanwhile, - I went to Hessdalen on the 31. rd of December 1986, and I was going to stay in the area until the 4th of January 1987. Like in the rest of this planet, there have been very hard weather conditions, with snowstorms and temperatures about 50-60 degrees C below zero. Because of this conditions I personally am glad the project were cancelled.

On the 2. nd of January at 03.12 o'clock I saw an oblong yellow white light, which moved from south towards northwest close to where I was standing together with my dog. He went some scared, when the phenomenon passed nearby the mountain and dived into a deep valley further north.

Unfortunately, I had not my camera at this time.

The reason for that is that when I have had my earlier sightings (aprox. 30-40), - I have noticed that the phenomenon in few cases has disappeared into nothing when I was trying to photograph it. Therefore I have been testing to walk around in the mountains without any camera or other instruments, to see if it might be affecting the appearance of the phenomenon.

I was speaking to some of the livings in the valley, and it seemes that the phenomenas still are appearing in the area, but absolutely not as it was in 1982-84.

Meanwhile it is still there, and we look forward to come this strange lights closer, if we at any time will be able to do so.

Sightings of the "typical" Hessdalen phenomænas, since January the 1st. 1987.

870102-I at 03.12 pm. oblong, yellowwhite
870107-I at 07.50 pm. globe, white
870108-I at 09.49 am. globe, red
870109-I at (08.00 pm.) oblong, yellow
870112-I at 07.55 pm. oblong, yellowwhite and some "dark" parts.
() = uncertain time.

PROJECT HESSDALEN

Leif Havik
N-7490 Rognes,
Norway

bol 0040

Gallery of Nature by the Rev. Thomas Milner (c. 1860) which includes the following detailed account by a Mr Blesson:

'The first time I saw the ignis fatuus was in a valley, in the forest of Gorbitz, in the New Mark. This valley cuts deeply in compact loam, and is marshy on its lower part. The water of the marsh is ferruginous, and covered with an iridescent crust. During the day, bubbles of air were seen rising from it, and in the night blue flames were observed shooting from and playing over its surface. As I suspected that there was some connection between these flames and the bubbles of air, I marked during the day-time the place where the latter rose up most abundantly, and repaired thither during the night; to my great joy I actually observed bluish-purple flames, and did not hesitate to approach them. On reaching the spot they retired, and I pursued them in vain; all attempts to examine them closely were ineffectual. Some days of very rainy weather prevented further investigation, but afforded leisure for reflecting on their nature. I conjectured that the motion of the air, on my approaching the spot, forced forward the burning gas, and remarked that the flame burned darker when it was blown aside; hence I concluded that a continuous thin stream of inflammable air was formed by these bubbles, which, once inflamed, continued to burn, but which, owing to the paleness of the light of the flame, could not be observed during the day. On another day, in the twilight, I went again to the place, where I awaited the approach of night: the flames became gradually visible, but redder than formerly, thus showing that they burnt also during the day; I approached nearer, and they retired. Convinced that they would return again to the place of their origin when the agitation of the air ceased, I remained stationary and motionless, and observed them again gradually approach. As I could easily reach them, it occurred to me to attempt to light paper by means of them; but for some time I did not succeed in this experiment, which I found was owing to my breathing. I therefore held my face from the flame, and also held a piece of cloth as a screen; on doing which I was able to singe paper, which became brown-coloured, and covered with a viscous moisture. I next used a narrow slip of paper, and enjoyed the pleasure of seeing it take fire. The gas was evidently inflammable, and not a phosphorescent luminous one, as some have maintained. But how do these lights originate? After some reflections, I resolved to make the experiment of extinguishing them. I

followed the flame; I brought it so far from the marsh that probably the thread of connection, if I may so express myself, was broken, and it was extinguished. But scarcely a few minutes had elapsed when it was again renewed at its source (over the air-bubbles), without my being able to observe any transition from the neighbouring flames, many of which were burning in the valley. I repeated the experiment frequently, and always with success. The dawn approached, and the flames, which to me appeared to approach nearer to the earth, gradually disappeared. On the following evening, I went to the spot and kindled a fire on the side of the valley, in order to have an opportunity of trying to inflame the gas. As on the evening before, I first extinguished the flame, and then hastened with a torch to the spot from which the gas bubbled up, when instantaneously a kind of explosion was heard, and a red light was seen over eight or nine square feet of the marsh, which diminished to a small blue flame, from two and a half to three feet in height, that continued to burn with an unsteady motion. It was therefore no longer doubtful that this ignis fatuus was caused by the evolution of inflammable gas from the marsh.'

[V.J. Ballester Olmos]

601 0041

Mrs. Domenica E. Falcione
15 Taft Drive
Winchester, Massachusetts 01890

August 3, 1986

Museum of Science
Science Park
Boston, MA 02114

Gentlemen:

I would appreciate receiving any information on "red ball lightning" for the following reason.

July 3, 1986 was a cloudy, drizzly day with possible thunderstorms, especially in the late afternoon. At approximately 1:15 P.M. we had a sudden brief rainshower. At 2:20 P.M., I looked out of my kitchen window which faces north, and saw a huge red ball in the sky. I thought it very strange, never having ever seen one before. I am 70 years old, and have seen many lightning bolts, including one which hit, which produced a blue flash and smell of ozone. There was no flash from this red ball, but an explosion so loud that it sounded like a bomb right over my house, and I thought the roof had collapsed. I am recovering from a stroke and two cardiac arrests, and I thought the fright would surely kill me.

A meter for the automatic sprinkler system had been blown off the garage wall and was smoking, with pieces of it all over the floor. The garage wall was dented and damaged. When the firemen arrived, they found serious electrical damage to the fuse box, with even the main fuse burned. All major appliances had been affected, and nothing worked. An electrician restored temporary service. Four weeks later, things are almost repaired.

I told the firemen about the red ball, ³ and they said they ^(at least 2) also had seen it, and said, "Oh, my God, where is it going to hit?" ~~Four~~ of my neighbors also saw it, and were very frightened, especially of the tremendous explosion.

The encyclopedia calls this "red ball lightning" which some scientists take very seriously, and some do not.

I would really appreciate receiving any information you have on this phenomenon.

Very sincerely yours,

Domenica E. Falcione

Domenica E. Falcione (Wife, Alfred M.)

P.S. Every house on my side of the street was affected in some way. Fuses were blown, lamps were knocked down, pictures on walls were turned, and some were thrown to the floor, all burglar alarms went off, and everyone who had an automatic sprinkler system had the water turned on. A few lost telephone connections. The street was really hit, but my damage was the worst.

CREDIT: WALTER N. WEBB/DENNIS STACY

bol 0042

NOTES & QUERIES (London) 5th Series
Vol. 3, p. 306 Apr. 17, 1875

WALES.—A gentleman
... women, a coast town in Carnarvon-
shire, to the *Field* newspaper of Feb. 20, as
follows :—

“Some few days ago we witnessed here what we have never seen before—certain lights, eight in number, extending over, I should say, a distance of 8 miles; all seemed to keep their own ground, although moving in horizontal, perpendicular, and zig-zag directions. Sometimes they were of a light blue colour, then like the bright light of a carriage lamp, then almost like an electric light, and going out altogether, in a few minutes would appear again dimly, and come up as before. One of my keepers, who is nearly 70 years of age, has not, nor has any one else in this vicinity, seen the same before. Can any of your numerous readers inform me whether they are will-o'-the-wisps, or what! We have seen three at a time afterwards on four or five occasions.”

Surely we are not going to have a repetition of the “Fiery Exhalation” mentioned by Evelyn in his *Diary*, 22nd April, 1694, and fully discussed in Gibson’s continuation of Camden. These “Mephitic Vapours,” as they were called, occurred on the same coast.
A. R.

Croeswylan, Oswestry.

[Janet Bord]

bol 0043

LA "BOULE DE FEU" DU BREST-PARIS

Dans diverses éditions régionales du journal « Ouest France » du 18.12.1968, on pouvait lire, annoncée sous le titre « Un étrange phénomène lumineux dans le ciel de Bretagne : une boule de feu a suivi le rapide Brest-Paris », la dépêche suivante :

SAINT-BRIEUC — Lundi soir, le rapide Armor avait à peine quitté Saint-Brieuc, peu après 19 h, en direction de Rennes, au'un voyageur briochin bien connu et, de plus, digne de foi, aperçut dans le ciel sur la droite du train une étrange boule de feu brillant d'un intense éclat blanc. La lumière se déplaçait sur une trajectoire qui épousait si fidèlement celle du train qu'il crut à un reflet dans la vitre. On baissa celle-ci, mais la boule de feu était toujours là, montant et descendant, passant parfois à quelques centaines de mètres d'altitude, parfois au ras du sol.

Tout le compartiment n'eut bientôt plus d'yeux que pour la « chose », puis ce fut le compartiment voisin.

A Rennes, plus de vingt personnes commentèrent le phénomène toujours fidèle au poste, attendant peut-être le départ du train pour reprendre aussi la route. En effet à Lamballe, la boule de feu s'était arrêtée en même temps que l'express.

A proximité des agglomérations, tout au long de la route, elle s'attardait au-dessus des maisons et puis elle rattrapait le train un peu plus loin.

Les voyageurs se refusent à penser à une illusion d'optique. L'hallucination collective est exclue. Alors, qu'était-ce ? Un hélicoptère ?... Une soucoupe volante ?

Le lendemain 19.12.1968, « Le Parisien Libéré » se faisait l'écho de la nouvelle, en des termes qui s'accordaient dans l'ensemble avec ceux de la dépêche d'« Ouest France » mais avec quelques nuances ou additions. L'objet était dé-

crit comme « un engin sphérique de couleur blanche métallisée » dont on nous disait qu'il avait épousé « tout d'abord la trajectoire parfois sinueuse du train » et qu'à Lamballe il s'était arrêté « à la verticale du train » pour reprendre ensuite « son curieux cheminement le long de la voie ferrée ». On ajoutait que, peu avant Rennes, il avait pris de la hauteur pour disparaître subitement derrière les nuages et que, « pendant près d'une heure les voyageurs de l'« Armor » avaient été intrigués par cette mystérieuse boule de feu... « On aurait dit un chien suivant son maître... ».

●
Nous ne savions encore que penser de cette observation lorsque nous avons reçu d'un de nos abonnés de Rennes, M. E. Barrier, une lettre, datée du 9 février, nous apprenant que, de sa propre initiative, notre correspondant avait mené une enquête sur le cas et qu'ayant pu se procurer l'adresse du principal observateur, Mr D., habitant Saint-Brieuc, il lui avait adressé un questionnaire que nous reproduisons ci-dessous avec les réponses du témoin :

D. — L'Armor a quitté Saint-Brieuc à 18 h 58. Combien de temps approximativement après son départ avez-vous aperçu la boule ?

R. — En regardant à l'extérieur, au niveau d'Yffiniac.

D. — Avez-vous remarqué quel temps il faisait, s'il y avait des nuages, du brouillard, etc. ?

R. — Temps brumeux.

D. — Vous avez aperçu la boule sur la droite du train. Est-elle restée constamment à droite ?

R. — Oui.

D. — La boule s'est arrêtée à Lamballe. A quelle hauteur était-elle au-dessus de l'horizon, approximativement ?

R. — En traversant Lamballe, nous n'avons rien vu.

'Phénomènes Spatiaux' no 2, June 1969.

[Jean Sider][Claude Nauge]

D. — L'article d'« Ouest France » dit que vous avez baissé la glace du compartiment pour vous assurer qu'il ne s'agissait pas d'un reflet. Est-ce exact ?

R. — Oui.

D. — La forme de la boule est-elle restée constamment sphérique ?

R. — Oui.

D. — De quelle grosseur était la boule, par exemple par rapport à une pièce tenue à bout de bras ? La grosseur a-t-elle varié ?

R. — Oui (1). Non.

D. — Quel aspect, quelle couleur avait-elle ? A-t-elle changé de couleur ?

R. — Blanche. Non.

D. — Il est dit dans l'article que la boule passait « parfois au ras du sol ». De quelle manière vous en aperceviez-vous ? La boule s'interposait-elle parfois entre vous et le paysage ?

R. — Oui.

D. — La boule « montait et descendait ». De quelle manière exécutait-elle ses mouvements ? Brutalement ou non ?

R. — Assez rapidement, sans inertie.

D. — A proximité des agglomérations, la boule « s'attardait au-dessus des maisons et rattrapait le train un peu plus loin ». Pouvez-vous décrire ces mouvements ?

Le témoin répond à cette question par le dessin suivant :



D. — De quelle façon la boule a-t-elle disparu à l'arrivée à Rennes ?

R. — Avec les immeubles (2).

D. — Combien de personnes ont vu le phénomène ? Connaissez-vous les adresses de certaines d'entre elles ?

R. — Vingt. Non.

D. — Avez-vous d'autres détails intéressants à signaler ?

R. — Non.

D. — Désirez-vous conserver l'anonymat si ces renseignements venaient à être publiés ?

R. — Oui.

Dans sa lettre du 8 février, M. Barrier, notant que les réponses que Mr D. avait eu l'amabilité de faire au judicieux questionnaire qu'il lui avait adressé corroboraient le contenu de l'article du journal (3) tout en y ajoutant un certain

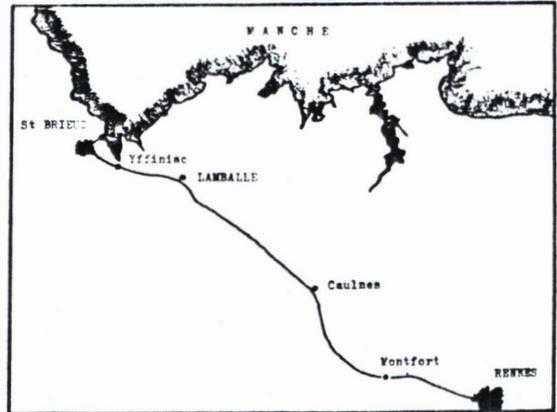
(1) Sans doute faut-il comprendre que la grandeur apparente de la boule était comparable à celle d'une pièce tenue à bout de bras (NDLR).

(2) Le témoin veut probablement dire qu'elle a été cachée par les immeubles de la ville (NDLR).

(3) Signalons tout de même qu'à lire le journal on a le sentiment que la boule, « fidèle au poste », était encore visible à Rennes, alors que Mr D. paraît affirmer que cette même boule a disparu à l'arrivée en gare, cachée par les immeubles de la ville (NDLR).

nombre de précisions, poursuivait en ces termes :

« Le phénomène a été aperçu au niveau d'Yffiniac, c'est-à-dire très peu de temps après le départ du train de Saint-Brieuc, qui a eu lieu, si le train était à l'heure, à 18 h 58, et il a disparu à l'arrivée à Rennes, qui a lieu à 20 h. Entre-temps, l'Armor ne s'arrêta qu'une fois à Lamballe à 19 h 14.



La voie ferrée entre Saint-Brieuc et Rennes

« Si l'on veut trouver au phénomène une explication, je pense qu'il est raisonnable d'écarter l'hypothèse de l'hallucination ou de la vision d'un hélicoptère, d'un avion ou d'un ballon-sonde, étant donné la durée de l'observation (environ une heure), la distance parcourue et le nombre des témoins.

« Une autre hypothèse a retenu mon attention : celle de l'illusion d'optique et, en particulier, la confusion avec une étoile ou, plus probablement, la planète Vénus.

« En effet, l'observateur a constamment aperçu la boule lumineuse à droite du train, c'est-à-dire dans le secteur ouest-sud-ouest du ciel. Or, il me semble que Vénus, à la date de l'observation, se trouvait dans cette région du ciel, et les heures devraient également coïncider. De plus, il me semble que Vénus était alors particulièrement brillante (1).

« Le fait que les dimensions, forme et couleur du phénomène soient restées constantes va à l'appui de cette hypothèse.

« Quant aux mouvements attribués à la boule : passages au ras du sol, montées et descentes, arrêt à Lamballe ils pourraient être attribués au mouvement propre du train, ce dernier traversant une région bretonne où les dénivellations de terrain sont nombreuses.

(1) A la date de l'observation, Vénus avait une magnitude visuelle de $-3,9$ et la fraction de la surface de son disque qui était illuminée était de l'ordre de 70 %. Sans être à son maximum d'éclat, la planète était donc passablement brillante (R. F.).

« Les seuls faits qui vont à l'encontre de cette hypothèse consistent en ce que l'observateur affirme que la boule s'est interposée entre lui et le paysage et qu'elle ralentissait au-dessus des agglomérations pour rejoindre le train un peu plus loin.

« En tout état de cause, le manque de précisions ne permet pas de porter un jugement définitif ».

Nous ne pouvions que féliciter M. Barrier de son esprit d'initiative, de son sens critique et de son ingénieuse perspicacité. De la réponse que nous lui avons adressée, nous extrayons les lignes suivantes :

« Grâce à vous nous tenons des précisions du principal témoin lui-même et, qui plus est, vous proposez une explication des faits qui est d'un très grand intérêt, une explication à laquelle nous aurions pu ne pas penser. Vous la défendez fort bien, du reste, et elle pourrait être exacte. Nous serions alors devant un cas ressemblant beaucoup à celui de « La boule de l'Erdre » (2).

« A Paris, le 16.12.68, Vénus s'est levée à 11 h 29 et couchée à 20 h 17 (je donne les heures en temps civil). Elle a dû passer au méridien à 15 h 33 environ et sa hauteur méridienne devait atteindre 21°. Elle a dû se coucher sensiblement au Sud 59 Ouest.

« Ces indications valent pour Paris même mais, à quelques minutes d'écart près, elles sont également valables pour les lieux de l'observation. Elles paraissent bien confirmer votre hypothèse. On remarque notamment qu'à partir du moment où Vénus s'est couchée (vers 20 h 10 localement), le témoin a cessé de voir l'objet.

« Au point où nous en sommes, je pense qu'il serait utile que vous posiez au témoin un certain nombre de questions.

« Il serait bon notamment qu'il précise davantage quelle était, au moment de l'observation, la visibilité. Il parle d'un temps brumeux. Si la brume régnante n'était pas assez épaisse pour interdire la vision de Vénus comment se fait-il qu'il ne l'ait pas vue alors qu'il regardait dans sa direction ?...

« Si le témoin a effectivement observé Vénus pendant près d'une heure, l'objet de son observation a dû, en moyenne, perdre graduellement de la hauteur — relativement à l'horizon.

« Comme vous l'avez justement noté, ce qui reste le plus troublant, c'est la déclaration du témoin selon laquelle il aurait vu l'objet s'interposer entre le paysage et lui. S'il a observé Vénus à travers des arbres, il a pu avoir l'impression qu'elle se trouvait entre ces arbres

(2) Voir « Phénomènes Spatiaux » N° 18, page 29 (NDLR).

tes admirables. Nous ne devons pas avoir peur de reconnaître que nous nous sommes trompés et, réciproquement, nous devons respecter l'homme qui, en toute bonne foi, a commis ce genre d'erreur que l'on qualifie de « risible » mais dont personne n'est à l'abri.

En attendant, nous pouvons reprendre à notre compte la conclusion de la première lettre de M. Barrier et dire qu'il nous est impossible, dans l'état présent de nos informations, de porter un jugement définitif. Nous penchons néanmoins pour l'explication par Vénus.

Quand la dimension réelle d'un objet n'est pas connue, on peut commettre — nous l'avons maintes fois constaté au cours de nos enquêtes — les pires méprises sur son altitude et sa distance. On notera, de surcroît, que le temps étant, au dire même du témoin, brumeux, la dimension apparente de Vénus

et lui. S'il l'avait vue entre une façade et lui, l'explication par Vénus ne tiendrait pas.

« Le témoin compare, semble-t-il, la grosseur de l'objet à celle d'une pièce tenue à bout de bras, mais il ne dit pas quelle pièce : 1 centime, 5 centimes, 1 franc, 5 francs ? S'il pouvait comparer cette grosseur à celle de la pleine lune, ce serait plus explicite.

« Si l'on pense qu'un objet — en fait très éloigné — se trouve à une assez faible distance, il paraîtra aller d'autant plus vite que les objets servant à le repérer seront plus proches du train roulant à grande vitesse. Quand on se servira comme repères d'objets plus distants du train, l'objet observé paraîtra ralentir, voire s'immobiliser. Or, quand le train franchit les stations, l'espace entre le train et les premiers objets pouvant servir de repères s'agrandit, en général, notablement, et cela peut donner le sentiment que l'objet observé ralentit, s'attarde au-dessus des constructions lointaines. Le franchissement des stations importantes peut aussi s'accompagner d'un ralentissement du train lorsqu'il passe sur les bretelles de ces stations. Ce fait irait dans le même sens mais, bien souvent, des stations, même importantes, sont traversées à très grande vitesse par les rapides.

« Puisque vous vous êtes si bien acquitté de la première phase de l'enquête, je pense que je puis vous en laisser la direction... ».

Un long silence avait suivi l'envoi de notre lettre et nous nous demandions si elle était effectivement parvenue à son destinataire. Mais celui-ci vient de nous écrire et nous apprend qu'il avait lui-même écrit une seconde lettre au témoin pour laquelle il a vainement attendu une réponse. Il nous dit, parlant de ce témoin : « Il est dommage qu'il n'ait pas cru devoir me fournir les indications supplémentaires qui vous étaient nécessaires ».

Inutile de dire que nous partageons le sentiment de M. Barrier.

Mr D. s'est-il finalement rendu compte qu'il avait pu prendre Vénus pour un objet insolite et serait-ce l'explication de son silence ? Si c'est le cas, nous pouvons comprendre son attitude et nous incliner devant elle, mais nous la regrettons, et d'autant plus qu'il ne fut pas seul à se tromper — s'il s'est vraiment trompé. Toutes les démarches humaines sont menacées de méprise, et le progrès de la science elle-même s'est fait à travers d'innombrables erreurs dont certaines, qui nous paraîtraient risibles aujourd'hui, ont été commises par de très grands esprits auxquels nous devons, dans d'autres domaines, des découvertes

avait bien pu être dilatée par un phénomène de halo. De toute façon, cette planète est un objet dont il convient de beaucoup se méfier car elle a abusé beaucoup de gens. Nous n'en sommes plus, personnellement, à compter le nombre d'appels téléphoniques que nous avons reçus d'observateurs qui avaient été les victimes de son séduisant éclat.

Nous redisons tous nos remerciements et compliments à M. Barrier qui nous a apporté un concours inestimable.

Références de presse :

« Ouest France » du 18.12.68 ; « Le Parisien Libéré » du 19.12.68.

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A MYSTERY UNSOLVED - The Story of the Min Min Light

By N.W. Bauer

(LATE
(Qld) Commissioner
for Police)

In 1613 three young men, Blaxland, Lawson and William Charles Wentworth, found a path over the Blue Mountains from Sydney side to the Bathurst Plains. Wentworth went on to become an active and valued citizen of the Colony of New South Wales. Author; Poet; Barrister; Editor of the first newspaper of the Colony, 'The Australian'; President of the Legislative Assembly and co-founder of the first University in Sydney - these are but a few of the talents he displayed. He built the gracious mansion, Vaucluse House, now famous as an historical museum and furnished just as it was when Wentworth lived there.

Down through the years, the Wentworths played a prominent part in the history and achievements of New South Wales and Australia.

In 1978, after twenty-eight years of a mercurial career in the Commonwealth Parliament, the fourth William Charles Wentworth, with much media publicity, came to Queensland to settle once and for all the origin and substance of that remarkable phenomenon, the Min-Min Light, but here the Wentworth magic failed. The enigma of this mysterious light in Western Queensland remains.

What then is this strange light which, for almost a hundred years, has mysteriously appeared to hundreds of people in the Winton-Boulia area and then, just as mysteriously, has disappeared? Most sightings have been near where the old Min Min Hotel once stood on the old coach road linking Winton and Boulia.

The phenomenon usually appears as a luminous oval like a fluorescent football, sometimes stationary, sometimes moving, sometimes advancing, sometimes receding, sometimes hovering in the air, sometimes bouncing and rolling but never coming close enough to be positively identified. Its light is not constant as it floats through the air, seemingly inviting one to follow.

[MARK MORAVEC]

On foot, on horseback and in motor vehicles, men have chased it - and some have been chased by it - but none has ever got close enough to see exactly what it was. A man of the cloth from Townsville once chased it in a car for miles but never gained on it. When going towards it, the light would recede, keeping at a constant distance. When the chaser turned to go away, the light followed, still at the same distance.

There appears to be no specific distance from the viewer that the light would first appear. Sometimes it would appear half a mile away and at other times quite close. At times it would approach a viewer along a road and then suddenly disappear when it was close. Some have claimed that the light got as close as ten or fifteen feet before it suddenly disappeared leaving no indication as to its nature or cause.

There are no regular times or seasons when it can be guaranteed that the light will be seen. It has appeared in different months and at different phases of the moon. It is not a frequent occurrence and sometimes years may elapse between sightings. Indeed, many have lived a whole lifetime in the district and have never seen it. It appears that the only recipe for seeing the light is to be in the locality when and where it shows itself. There are some who would say that the only recipe is one involving barley and malt and sugar. But enough sightings by by sane, sober and intelligent persons have occurred to discount that recipe.

Hundreds have seen the Min Min Light; many guesses, theories and explanations have been propounded; but no one has made an acceptable explanation. The mystery remains. Scientists, photographers and TV crews have stayed out on long and lonely nights, but the light refused to assist and failed to appear.

Yet to those who have seen it it is real, so real that some, believing it to be the headlight of an approaching

cer, have in the true hospitality of the outback, put on the billy to make welcoming tea for the approaching stranger. But then it disappeared without trace.

I have been unable to find a reliable record of when this strange light was first seen, but it goes back beyond the memory of the present old-timers of the area. Undoubtedly, it was first seen in the vicinity of the old Min Min Hotel. It is even uncertain whether the light was named after the Hotel or the Hotel after the light.

No record is available as to when the Min Min Hotel was built. It was a change station for Cobb & Co. coaches travelling between Winton and Boulia. Some have described it as a shanty built of slabs while others have claimed it was built of corrugated iron. It is known to have been in operation in 1912, but by 1918 it was reduced to a heap of rubbish and piles of empty bottles. It is thought to have been burnt down sometime between 1916 and 1918.

I visited the site of the Min Min Hotel in 1980, but all that remains is a large area of broken glass and some iron railings from around graves that were in the cemetery at the rear of the Hotel. The Winton-Boulia road does not pass close to the site of the old shanty, having been moved about a quarter of a mile to the North.

One of the first recorded sightings of the light was by Henry G. Lamond, manager of Warenda Station on which property the Min Min Hotel was situated. His account of the sighting was published in the 'North Australian Monthly' in January, 1961.

'Just as he wrote it,
Verbatim will I quote it.'

"I saw the light once. During 1912 I was managing Warenda Station, then the biggest station in Queensland.

One night in the middle of winter of that year, either June or July, I finished off my office work, caught my favourite stock mare 'Nellie', saddled her and left Warenda

about midnight to ride twenty-seven miles to Slasher's Creek, to start lamb marking in the morning.

My road from the Station was about twelve miles down the Hamilton River to the Hamilton Pub. There I turned left at the junction with the Boulie Road. I crossed the Hamilton Channels and rode along the open downs of the Winton Road and eventually turned right and rode towards Slasher's Creek. (Warenda is on the North side of the Winton-Boulie Road and Slasher's Creek is on the South side.)

I had crossed the creek and was out on the high downs, riding along about two o'clock in the morning. It was cold. The winds were whistling from the South-East and there was a touch of ice in the air. I was riding along at a brisk trot to keep myself warm and was singing to break the monotony.

Suddenly, a light appeared on the road ahead of me, coming from the direction of Winton. It appeared to be about half a mile away when I first saw it. It wasn't a car light. Cars were not common in the country then, and besides, it was too high above the ground to come from a car. It was greenish in colour, just about the size of a car headlight, and it floated rather than travelled. It cast a glow all around instead of cutting a line ahead as a car light would have done.

I stopped singing but Nellie kept trotting along quite unperturbed. She didn't even prick her ears or lift her head. I know, had it been a car coming towards us, that mare would have been afraid. I wasn't frightened. Oh, dear, no!

The light approached straight towards us and got so close I could see the hairs on my forearm. It was so plain that I could see a small beetle pushing its way through the hairs on my arm.

Then - phut! - just like that, the light went out.

Although Nellie never paid the least attention to the light and just kept complacently trotting along, shortly afterwards when I struck a match to light a cigarette, she almost jumped from under me. Yet the ghost light, or whatever it was, didn't make her turn a hair or lift an ear.

I didn't try to solve the problem; it was beyond me. I had an idea the mare knew more than I did. If it wouldn't hurt her, it would do me no harm, but I will admit that I nearly jinked my neck a few times in the next few miles by suddenly looking back over my shoulder to see if anything was following me."

Another story of the manifestation of the light is that, shortly after the Min Min Hotel was destroyed, a stockman rode to the Boulia Police Station one night in a condition of funk and almost incoherent. He was induced to sit down until he regained control of himself, when he told this story:

"About ten o'clock this evening, I was riding to Boulia and passed close to the Min Min graveyard. The night was somewhat cloudy. All of a sudden I saw a strange glow right in the middle of the cemetery. It got bigger until it was the size of a large watermelon. I couldn't believe my eyes as I saw it hovering over the graveyard. I broke into a cold sweat as it started coming towards me. It was too much for my nerves. I dug the spurs into my horse and headed for Boulia as fast as I could go. Every time I looked back, the light seemed to be following me. It only disappeared just out of Boulia."

When he reached the Police Station, his horse was in a lather of sweat and he, himself, was in a state of terror. The Police made light of the story, and the whole town joked for months about the 'spook' he had seen.

Then in rapid succession came two more reports to substantiate the story of the stockmen. A woman and her husband riding in from one of the stations reported having seen a mysterious light or glow which, as they watched it, intensified in brightness and moved away from them. They were both

strangers to the area and had never heard of the Min Min light. Their feeling was one of curiosity rather than of fear. They turned off the track on to the hard plain country and followed the light for some distance but it kept moving away from them. They grew tired of trying to solve the mystery and turned to regain the track. Then a strange thing happened. The light which had been receding before them now advanced to follow them.

People in Foulie were now prepared to believe that there might be something supernatural about the Min Min light. It was well that they were prepared before the next story of the light came in.

Another station hand came galloping into Boulia a few nights later. He was in a condition bordering on hysteria. He had seen the 'light'. It had risen out of the old hotel graveyard and gone bounding through the air for a considerable distance until suddenly it disappeared.

Since the earliest sightings, the light has been seen by many people in various parts of the district. While in Boulia in 1920, I contacted a number of people who stated that they had actually seen the 'light'.

One old resident told me that one night he and his mate were sitting outside their hut some distance from Boulia. At about 9 p.m. they saw a light about a quarter of a mile away on the open plain. It hovered and bobbed about but remained in the same area until about midnight and then suddenly disappeared. A search in daylight next morning revealed neither tracks nor trace of the mysterious thing.

Perhaps the best authenticated recording of this remarkable phenomenon is one I received from from Detective Sergeant Lyall Booth of the Police Stock Investigation Squad stationed at Cloncurry.

I quote from his letter to me;

"I saw the Min Min light near Boulia. I will explain the circumstances to you.

With members of the Longreach Stock Squad, I was conducting a muster on Werra Station on the Hamilton River near Boulia. We were approximately 60Km east of Boulia on the main Boulia-Winton Road and about 2Km south of that road. The paddock in which we were mustering was known as 'Bulla Bulla' and there was a waterhole of the same name in the Hamilton River in the paddock.

We went to this paddock on Monday, 27th April, 1981, and set up camp. We mustered until 2nd May and then trucked cattle from the paddock on that date.

On the afternoon of Saturday, 2nd May all the men left the camp except me and the camp cook, a forty-year-old part Aboriginal woman.

The main camp was set up approximately in the centre of a plain several kilometres across and was beside a very shallow, drying-up waterhole ringed by gidgee trees. There was a set of portable steel yards on the Eastern end of the waterhole. I was camped on the bank of the Bulla Bulla waterhole, approximately 600 metres from the main camp.

I went to bed at about 8 p.m. that night (Saturday, 2nd May) and read until about 9 p.m. when I went to sleep. I had not partaken of any alcohol that day. It was a cool night. I wore a jacket to bed and had three or four blankets over me. The weather was fine and had been so for some time. There was no cloud. It was two days before the full moon.

I woke up at about 11 p.m. (I don't know why.) and saw a light which at first I took to be a car headlight, approximately 1500 to 2000 metres North-East from me. I thought it was a vehicle on the main road, but after a short time I realized that the main road was further to the North end that vehicle lights could not be seen plainly from my location. The light appeared to be just to the West of the Hamilton River channels and appeared to be moving but it

did not seem to get any closer. (I know that's hard to grasp, but that is how it appeared.)

The light was below tree-top height. Its intensity seemed to fluctuate a little and this may have given the impression of movement. It was a single light and white in colour, similar to the light thrown by a quartz-iodine headlight. After watching it for three or four minutes, I realized that it was probably the Min Min light.

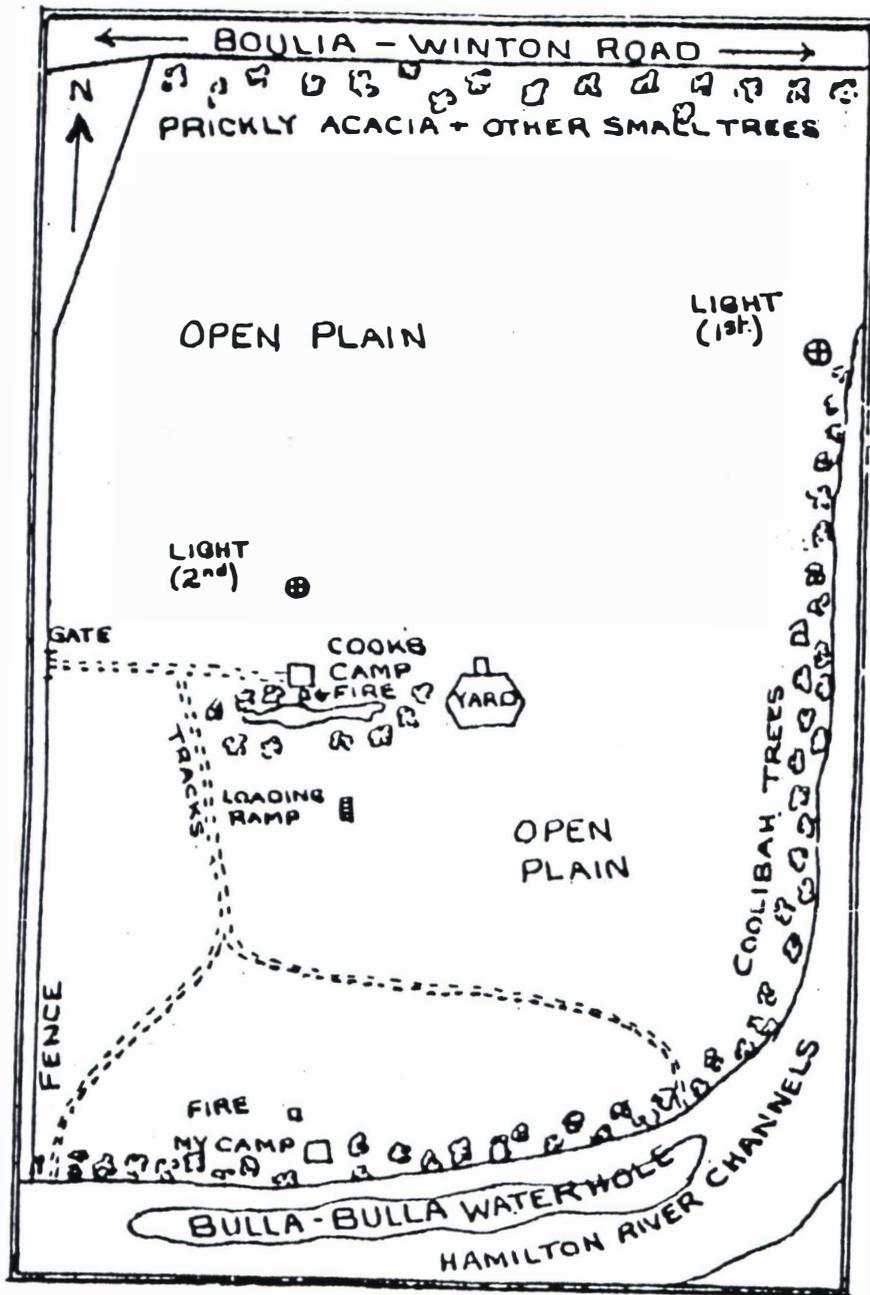
I kept it under observation for about half an hour and its position remained about the same. (I can't say the same for my pulse rate.) I went to sleep with some difficulty about midnight and awoke again at about 1 a.m. and saw the light again just to the North of where the cook was camped. That means that, if it was the same light, it had moved about 1000 metres to the South-West from its original position.

It was not as bright as the first light and had a slightly yellow colour to it. It was about the colour of a gas light which is turned down very low and is about to go out, but it was of much greater intensity than that type of light.

It appeared to be slightly bigger than the gas light used in the cook's camp. It seemed to be from three to six feet from the ground, and moved only several yards from west to east and then remained stationary. It illuminated the ground around it but I was too far away from it to see any detail. I could, however, see the cook's camp between the light and me.

I watched the light for about five to six minutes and then it suddenly dived towards the ground and went out. It may even have gone out on contact with the ground. I did not see it again.

Next morning, I checked with the cook and she had seen nothing. She had slept through the night; she had not been up during the night and no person had visited the camp. She and I were the only people in that area.



She had had a small camp fire earlier that night but it was not visible from my camp. Her fireplace was shielded on the South by tree branches. I had a small camp fire that night but by 8 p.m. only coals were left. That fire was to the North-West of me and not in my line of sight to either of the lights.

The weather that day had been fine and cool to warm. There were no mirages during the days I was there.

In the daylight I inspected the area where I had seen the light and could find no vehicle tracks. I could find no tracks where I saw the light disappear.

The soil was gray to black alluvial with small iron-stone pebbles through it. The grass was buffel and quite short on the plains. The main trees along the riverbank were Coolibah. The Gidgee around the waterhole is of the wattle or acacia family.

I am at a loss to explain in physical terms the lights that I saw. My inquiries lead me to believe that they were not caused by man.

I have drawn a rough map which may be of some assistance in understanding the positions of the various places I have mentioned.

Sightings of this light or similar ones are not uncommon. The local District Inspector of Stock, Mr. Mike Egan, has informed me that he has seen it several times, but many years ago. About sixteen years ago, he was travelling on a bush track near 'Monkira' which is near Badourie, when he saw a light the size of the moon travelling beside his vehicle. He tried to get away from it but it stayed with him, even when he was forced to slow down because of road conditions. He is an experienced bushman and not prone to exaggeration or panic. It was not the moon. It disappeared as suddenly as it came."

And so we get back to the headline of this article - 'A Mystery Unsolved'. What is the mysterious Min Min Light?

Many theories have been put forward, but none has stood the tests of science and reason.

Some have claimed it is a 'moon mirage'. Checks of the dates and times of known sightings reveal that the light has appeared at all phases of the moon and even when there was no moon at all.

Others believe it to be akin to the proverbial 'Will O the Wisp'. Certainly, there are some mud springs in the district and in some seasons these have been known to bubble, but no bubble of marsh gas or methane could possibly burn for hours on end and move over the great distances recorded for the elusive Min Min.

An interesting theory is that the light emanates from a swarm of fireflies. Fireflies are known in the district, and it is known that, under certain seasonal and atmospheric conditions, these fiery little insects will band together like a swarm of bees. Such swarms could, and probably do move in undulating paths such as those attributed to the mysterious light. And it is common knowledge that fireflies can switch on and off at will. But how many tiny fireflies would be needed to cast a light with the brightness of that credited to the Min Min light? Countless millions, perhaps. An interesting theory, but scientists say it is only a theory.

An even less likely suggestion is that owls, hiding by day in hollow trees, may brush against luminous fungi and themselves become luminous as they venture out at night. But who has seen an owl hover almost stationary for minutes on end? Hawks, perhaps, but not owls!

Perhaps you have an explanation or a theory that will stand testing. If so, let the Editor hear from you. Who knows? Perhaps in some future edition of this Bulletin we may be able to print a story entitled -

'A MYSTERY SOLVED - An Explanation of the Min Min Lights'

601 0045

p. 216-219

Correspondence

METEOROLOGICAL FLYING OBJECTS

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(Received 1979 December 31)

A suggested meteorological explanation of certain types of flying objects which would otherwise be described as UFOs, has been published (1) and as this has implications in astronomy the hypothesis is briefly described in this letter.

A stroke of lightning is an electrical discharge in the atmosphere arising from a voltage gradient. This electric field acts on both positive and negative charges, but the acceleration and average velocity is far greater for electrons than for any other particles, since their mass and volume are much smaller. When free electrons in the atmosphere are accelerated to velocities high enough to produce more free electrons in collision with the atoms of atmospheric gases, the process is called cascade ionization and there is a very large and rapid increase in the current flow, causing the general small leakage current to become a massive filamentary discharge, resulting in sudden high temperatures, emission of light and considerable acoustic noise. This is a very much simplified description of the processes responsible for terrestrial lightning, based on the detailed accounts in recent literature (2).

The voltage gradient which causes the flow of current acts on all charged particles, but it is generally assumed that 'all current is carried by electrons since the mobility of positive ions is low' (3). The main constituent of the gas in the discharge channel is nitrogen, which has a molecular mass of 2.34×10^{-26} kg. Electrons have a mass of 9.11×10^{-31} kg, so they would rapidly drain from the lightning channel to the zone of positive charge. The voltage gradient in a lightning channel is initially about 1 kV m^{-1} and as the force on a charge of $1e$ is 1.6×10^{-18} N, the theoretical acceleration of a singly ionized molecule of nitrogen would be

$$\frac{1.6 \times 10^{-18}}{2.34 \times 10^{-26}} = 6.84 \times 10^9 \text{ m s}^{-2}$$

A typical discharge duration is $40 \mu\text{s}$, and the theoretical final unimpeded velocity of the ionized molecule would be 274 m s^{-1} , and the distance travelled 5.5 m . These figures, of course, ignore many factors, such as the effect of the electrons travelling in the opposite direction and collisions with neutral atoms and the few negatively ionized atoms. Nevertheless, they indicate that a high longitudinal velocity of particles having relatively high mass is both possible and likely in a current discharge channel, even when

the voltage gradient has appreciably declined during the discharge. A realistic estimate of the velocity is that of sound at STP, namely 330 m s^{-1} , and if the acceleration to this velocity is linear, the distance travelled in $40 \mu\text{s}$ is only 6.3 mm. There would be a long string of ionized particles all acted on by a force in the same direction, pushing along with them a mass of neutral particles, following collisions in the channel. The kinetic energy of this long streak of gas, compressed by its own magnetic field, would be considerable, and one would expect it to be projected like a lance into the atmosphere far beyond the thunderstorm area.

It must be admitted that the evidence for such jets of matter arising from strokes of lightning is at present rather minimal, but in science it is often the case that certain features which later seem obvious are not noticed until observers expect to see them. There are, however, a few reliable terrestrial examples supporting this hypothesis and there are, in my view, many more in astronomical atmospheres, as described below.

One afternoon in 1971 July a retired general practitioner, Dr L.H.Worth, climbed to the rounded summit of the Puy Mary, 1770 m, in Central France. He could see a storm in the valley below him about 3 km away, and he heard thunder. A few seconds later, he felt a blast of hot air, so powerful that he had to lean against it, and this occurred three times in the next few seconds. He noticed that other people on the mountain near him rushed away for shelter. Some time later a friend persuaded him to write to *Nature* about his experience and the letter was published under the title 'Atmospheric mystery' (4). His letters with more details were also published in *Weather* (5) and *New Scientist* (6), but only one suggested explanation of this event appears to have been published (1). This is that the jets of air were caused by the successive strokes of lightning, and Dr Worth happened to be in the very restricted area above the level of the lightning where these jets impinged.

There may have been many such unreported incidents and there are many cases of unexplained accidents to aircraft in apparently still air conditions in flight some distance from thunderstorm areas which may have been caused by sudden violent disturbances caused by such jets. High voltage discharges in thermonuclear research show similar characteristics. 'No high pressure discharge in practice is free of gas flow' (7). Photographs showing a stroke of lightning rising from a point on the ground to meet a secondary stroke (8) also indicate that positive ions are active in a discharge channel. In another incident, an observer saw what appeared to have been luminous material ejected from lightning, followed by discharges from the ionized matter into zones of opposite charge (9).

If a stream of ionized air is ejected from a lightning discharge channel and approaches a grounded conductor, a charge of opposite sign would be induced in the latter, and if the jet stream has sufficient velocity and charge, a steady discharge would take place, which may be luminous. This seems a reasonable explanation of certain types of ball lightning (10) offering further evidence for discharge-generated jets. A similar process would occur in an encounter between two oppositely charged streams of air, as indicated by another theory of ball lightning (11).

Jets travelling in a roughly vertical direction into the upper atmosphere, produced by a stroke of lightning, seem likely to give rise to a phenomenon which I shall describe as a meteorological flying object, or MFO for short. An appreciable mass of water vapour is likely to be entrained in the compressed discharge channel, and this would cool and condense in the upper atmosphere. Such streaks of misty material, following a parabolic trajectory, would be particularly conspicuous when lit by morning or evening sunlight, and their shape and position would constantly change, so that if they were seen from a high-flying aircraft it would be very difficult to judge their distance and velocity.

An interesting situation arises if the water vapour in such streaks of mist freezes. The solid particles at the head of the moving column would encounter atmospheric resistance and their speed would reduce more than that of the following particles, causing the ice to bunch together, forming a solid lump, which would eventually fall to the ground shortly after the stroke of lightning responsible for the formation of the jet. Many cases of the fall of large lumps of ice have been reported and these are often considered to have been large hailstones or falls from aircraft. This is not a satisfactory explanation for many of the incidents, however, since hailstones do not fall as single isolated lumps of ice and aircraft did not exist at the time of most of these observations, or they produce quite different ice specimens from those found.

In one such case, the observation and report (12) were made by a qualified scientist who was a physicist of UMIST and a lightning observer for the Electrical Research Association, Dr R.F.Griffiths. He noted the time of occurrence of a single violent flash of lightning, then exactly 9 min later an object crashed to the ground about 3 m from where he was standing. The pieces indicated that the object had been a large piece of ice estimated to have weighed between 1 and 2 kg. From the largest intact piece it was seen that there were 51 layers of alternating clear ice and air bubbles. Careful subsequent investigations by Dr Griffiths showed that there were many reasons why the ice was unlikely to have grown on and fallen from an aircraft. A suggested explanation of this event, with rough calculations, is described below.

The ice was formed from the water vapour entrained in the discharge channel of the single powerful stroke of lightning. The layers were formed by the variation in density along the discharge channel because of the intermittent nature of the stroke of lightning, each layer being equivalent to 50–100 m of channel. The total length of the channel would therefore have been 2.5–5.0 km. The total weight of the ice lump was estimated to have been 1.4 kg from deductions about its probable shape. The amount of water vapour in the atmosphere is generally about 10 g per kg of air, and the density of air at STP is 1.2 kg m^{-3} . The volume of air which contains 1.4 kg of water vapour would then be 117 m^3 and if it is in the form of a lightning channel 2.5–5.0 km long, its diameter would be 240–170 mm. This is very close to the estimated diameter of 220 mm based on the shape of the ice lump.

The interval of 9 min between the flash of the lightning and the crash of the ice can be obtained by many combinations of the probable values of

height and velocity of the jet stream, as in the following example. Initial height of jet 6 km. Vertical speed 550 m s^{-1} . Calculated time to apogee 56 s. Vertical distance to top of trajectory 15.5 km. Total height 21.4 km. Terminal velocity 44.4 m s^{-1} (160 km hr^{-1}). Calculated time of fall to this velocity 4.5 s. Distance dropped 100 m. Time to fall remaining distance to ground at the terminal velocity 480 s. Total time from jet formation to ground contact of ice 540 s, i.e. 9 min.

It is very rare that an observation of this type is made by an observer with all the requisite qualifications for accuracy and investigative skill. If the claim that the ice could not have fallen from an aircraft and was not a giant hailstone, as stated by Griffiths (12), is correct, then it seems most probable that the stroke of lightning was responsible, giving further strong support to the view that in some cases lightning can produce powerful jets which are liable to be dangerous to aircraft.

These comments are intended to show that many UFO sightings probably have a natural physical explanation, not involving the less acceptable hypothesis of actions by extraterrestrial intelligences (13), and secondly that these characteristics are worth further study in relation to the much more extensive atmospheres in astronomy. There is a remarkable number of close similarities between electrical discharge characteristics and many astronomical phenomena (14), and although there are difficulties in relation to the charging processes involved, some answers to these problems have been published (15) and at least one other theory in the astronomical literature (16) is on similar lines.

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[T. PINVIDIC]

601 0046

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SUR UNE OBSERVATION DE « Foudre en boule » FAITE EN AVION

par M. BARATOUX,
Ancien Elève de l'Ecole Polytechnique
Pilote-aviateur.

RÉSUMÉ.

D'une observation faite au cours d'un voyage aérien, l'auteur conclut que la foudre en boule a une masse ; elle semble en outre chargée d'une électricité qui peut être contraire à celle d'un avion, d'où une attraction qu'une accélération brutale ne suffit pas à vaincre, mais que la force du vent de translation parvient à surmonter.

SUMMARY.

From an observation made during the course of an air-trip, the author concludes that a ball-thunderbolt has mass ; in addition, it seems to be charged with an electricity which can be contrary to that of an aeroplane, whence an attraction which cannot be overcome even by a fierce acceleration but which the power of a translating wind succeeds in surmounting.

RESUMEN.

De una observación efectuada durante un viaje aéreo, el autor llega a la consecuencia de que el rayo en bola presenta una masa ; parece además cargada de una electricidad que puede ser contraria a la de un avión, de donde se origina una atracción que una aceleración brutal no puede vencer, pero que la fuerza del viento de translación llega a dominar.

Mon ami, M. René GUYOMARD, et moi étions partis d'Orly le mardi 23 novembre 1948, à 22 h., à destination du Caire sur un Constellation de la T.W.A., le *State Of Indiana* (escales à Genève, Rome, Athènes).

Depuis l'Adriatique, temps très nuageux.

Au départ d'Athènes, à 9 h 55, couche de nuages entre 1000 mètres et 1500 mètres, soit 500 mètres d'épaisseur, puis autre couche entre 2300 mètres et 2700 mètres, soit 400 mètres.

Bien au-dessus, forte couche de cirrus.

Au fur et à mesure que nous approchions de l'Afrique, la nébulosité diminuait pour faire place à un temps de grains.

A 12 h 05, heure de Paris (heure locale 13 h 05), donc à une demi-heure environ de la côte (nous devions atterrir à l'aérodrome Farouk à 13 h. 10, donc 14 h 10, heure locale), tandis que nous déjeunions, j'ai senti comme un coup sous la cabine, à quelques mètres en avant de nous ; nous occupions les deux places situées à tribord au troisième rang, je crois, à partir de l'arrière, M. GUYOMARD étant près de la fenêtre, et moi près du couloir.

Aussitôt, première réflexion qui m'est venue instantanément à l'esprit : « On dirait qu'on a écrasé un chien ».

Puis, entendant quelque chose qui frottait sous la cabine, deuxième réflexion : « On dirait un bois frottant le long d'un bateau à l'ancre dans un courant ».

J'eus, en tout cas, le temps de cesser de manger pour regarder par le hublot ce qui allait se passer, et vis surgir du dessous de la cabine une boule de feu jaune légèrement orangé, un peu plus grosse qu'une balle de tennis, entourée d'une couche gris violet foncé de 2 ou 3 centimètres d'épaisseur, avec une courte queue, présentant un aspect spirale indiquant une rotation (fig. 1) ; elle allait presque à la même vitesse que nous.

Aussitôt je vis nettement cette boule éclater et donner un rayonnement,

par secteurs plus ou moins éclairés, gris violet pâle, presque blanchâtre, de plusieurs mètres de longueur (2 à 3 m) vers le haut et vers l'avant, seules portions de l'espace visibles pour moi (fig. 2).

M. GUYOMARD, qui a vu tout cela également, l'a comparé à un éclair de magnésium.

En même temps il y a eu une forte détonation, plus forte qu'un coup de revolver, et ressemblant à l'éclatement d'un gros pétard.

L'altitude était environ de 3.400 mètres, mesurée avec mon altimètre de poche Richard, récemment révisé : la cabine n'était certainement pas surpressée.

Cet éclatement a dû se produire à une trentaine de centimètres du flanc de la cabine.

Nous avons continué à regarder un instant pour voir s'il n'y avait pas de

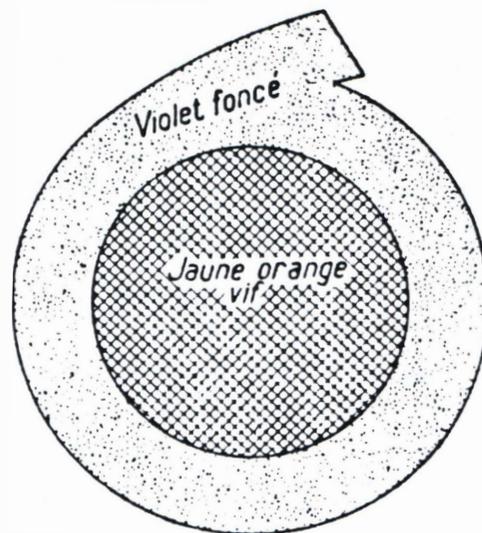


Fig. 1.

Aspect de la boule de face (réduction 1/2).

fumée, mais n'avons pas interrogé la Stewardess afin de ne pas semer l'inquiétude.

Malheureusement, à l'atterrissage, canalisé vers les formalités administratives, je n'ai pu joindre l'équipage (qui ne s'était certainement douté de rien) ni examiner la cabine.

M. GUYOMARD dit que la queue s'est soulevée avant ou au moment de l'explosion, je ne l'ai pas remarqué.

Tout d'abord j'ai cru à un formidable « raté » coïncidant avec un déplacement des bagages de soute, et ce n'est que quelques instants après, en apercevant, en avant et sur notre droite, une puissante formation orageuse, que j'ai pensé à la foudre en boule, si souvent décrite dans des récits à terre.

Cette formation, qui pouvait se situer à une dizaine de kilomètres, et que notre pilote contournait sagement, par l'Est, constituait un corset de peut-être un kilomètre de diamètre à la base, et allant jusqu'aux cirrus. Pour nous, à ce moment-là, le ciel était dégagé.

Il ressortirait de ces observations :

1° que la foudre en boule possède une certaine masse, suffisante pour qu'à 100 mètres à la seconde elle puisse donner un choc ;

2° qu'en l'espèce elle a été entraînée par l'avion,

a) puisque j'ai eu le temps de me détourner de mon assiette et de regarder par le hublot en me penchant vers lui, tandis que j'entendais le frottement contre la cabine ;

b) puisque j'ai pu discerner ce qui est exposé ci-dessus.
Le champ dont je disposais était très réduit.

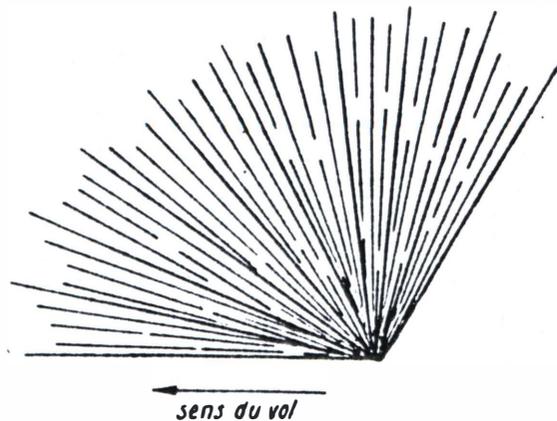


Fig. 2.
Aspect du phénomène
après disparition de la boule.

D'autre part, admettons un cinquième de seconde pour l'observation de la boule de feu, et un autre cinquième pour celle de l'éclatement, au total deux cinquièmes de seconde durant lesquels la boule n'a guère parcouru, relativement, que 50 centimètres ; celle-ci aurait eu une vitesse voisine de celle de l'avion, ce qui implique, si l'on part de zéro, une accélération considérable.

En réalité l'observation totale a dû durer au moins une seconde, sinon deux.

Tout s'est passé comme si une force avait plaqué cette boule contre l'avion, mais que le vent l'en aurait arrachée péniblement.

[T. PINVIDIC]

Those lights in the sky

Last week, I quoted from a letter from Mrs. R. of Lampeter. She and her husband saw an orange light, rectangular in shape with the outline of a cross at its centre. She continues:-

"On another night in late Spring this year at about 8 p.m. when it was almost dark and when there were no leaves on the trees, I saw an orange globe-shaped light float across the sky over our house and into the distance through the trees.

"It was much bigger than a star but not as big as the moon, or so it seemed. It went very much slower than a shooting star, so that I could follow it with my eye for five or ten seconds at least. This again travelled from south-east to north-west (approx.) and disappeared into the distance on the other side of Cefn Bryn towards Temple Bar".

Note that Mrs. R's globe floated and was slow moving. The colour of many objects about which readers have written is orange. I know Mars is similar in colour, but I don't think anyone could suggest that all such sightings can be of the planet. And planets or stars will not be seen to 'float'. Shooting stars can be put down to meteors or, as was mentioned last week, 'space debris' created by humankind.

Dafydd G. wrote from Tremadog about a sighting in the 1950's at Chwilog, Caernarfonshire:-

"The light was observed on 28 August, 1953. The whole affair is included by a Mrs. G. of Birmingham in a letter to the Rev. W. Rector of Llan... at the time. An orange light was seen at a quarter to three in the morning. Mrs. G. was travelling in a car. This light was travelling at the height of about four to five feet above ground level and was coming towards the car.

"It disappeared for a time before making a re-appearance. When the car reached Y Ffor (Fourcrosses) the light completely disappeared.

"The facts are contained in an article by Dyfed Evans ... and can be found ... in Y Cymro, 25th September, 1953.

"... this area ... consists of very old rock formations. From time to time photons are set free ... Such photons remain in the atmosphere for a time before disappearing.

by: Llowarch

"Our knowledge of such phenomena is scarce. Perhaps people's imagination results in giving form to such strange things as aliens, flying saucers and UFO's. ... when more evidence is gathered a clearer picture will result."

What if the object seen is *not* a light and, therefore, not a photon? Such a description came to me from Mr. P., Dolgellau:-

"What I saw," he writes, "was a black disc go across the sky. I was looking up at the stars when this thing drifted across blotting them out. It went from north to south quite steadily and was about the size of a new penny held at arms length.

"I watched it for about half a minute, though I can't be sure of the exact timing. It was soon after dark, about eleven o'clock on a June night".

Mr. P. didn't mention it to anyone until he read my "Light in the Sky" article. This natural fear of ridicule must mean that most odd sightings go unreported. There's also the fact that many of us take these things as normal. That Mr. P's disc did not emit light and had no colour shows it to be different from other sightings.

So what are these things? Having witnessed some of them personally and in all sorts of places, I feel that we need to investigate and correlate all such information. On a merry whim, my friend Pat wrote to me reminding me that I'd promised to organise some sort of UFO watch. This promise was made a long while back and she accuses me - tongue-in-check - of being "affeared".

Well, I'm anything but "affeared", Pat. Yet, because so much has come to light (no pun intended) since the "Light in the Sky" appeared in Cambrian News, perhaps a really well organised watch is necessary. Therefore, write to me if you're interested and we'll do it very soon.

CAMBRIAN NEWS

19.9.1986

[J + C BORD]

EFFETS DU TONNERRE (1).

LE 17 du mois d'août 1684, un orage impétueux s'éleva sur le Village de Saint Pierre des Fresis, & répandit l'alarme parmi les habitans.

La mere du Curé du lieu accourut à l'Eglise avec son fils, dans l'idée que le tonnerre qui grondoit horriblement n'oseroit violer ce saint asyle. Deux de leurs valets les suivirent, & un autre homme y étant entré en même-tems sonna la cloche pour dissiper cet orage.

Après avoir sonné un quart-d'heure, il donna sa place à un des valets & sortit de l'Eglise. Quand il fut dans le porche il jugea que le tonnerre étoit sur sa tête, & s'avança précipitamment vers le Cimetiere; mais tout-à-coup il vit environ à vingt pas de lui une colonne de feu qui venoit vers l'entrée du porche, & qui, changeant de figure, ne fut plus qu'un globe enflammé. Ce globe, qui jetoit de toutes parts des étincelles en pétillant, étoit élevé de terre de trois ou quatre pieds.

(1) Mercure Galant, octobre 1684.

210

posture étoit le domestique qui avoit sonné la cloche après lui. Un peu derriere il apperçut l'autre valet qui étoit demeuré à genou, son chapelet à la main, & contre l'autre muraille il vit la mere du Curé à genoux. Il s'avança vers l'Autel, & tandis qu'il prioit, il entendit comme le dernier soupir d'un des quatre qui expiroit; il se tourna & revint à ces corps & n'y trouva aucun mouvement.

On les laissa dans le même état jusqu'à la nuit, & ils furent vus d'une infinité de personnes qui accoururent des lieux voisins. On les visita par ordre de la justice, & on trouva le Curé brûlé, comme s'il avoit été rôti sur le gril depuis la jambe gauche jusqu'au cou; en sorte qu'il n'y avoit que cette moitié de son corps qui parût offensée. Sa chemise & son caleçon étoient brûlés, ensanglantés & déchirés en quelques endroits, mais seulement de ce côté-là. Ce qu'il y avoit de remarquable, c'est que sa soutanelle étant aussi déchirée, comme si on y eût appliqué en divers endroits un mail de fer, la doublure n'étoit point du tout endommagée. Son collet de toile fut brûlé du même côté, & son collet de pourpoint demeura entier. On trouva aussi

ET AUTRES JOURNAUX. 209

Cet homme forcé de revenir sur ses pas & conservant toujours beaucoup de présence d'esprit, crut qu'il devoit rentrer dans l'Eglise. Il avoit déjà un pied sur le seuil, quand faisant réflexion que le tonnerre alloit l'y suivre & passeroit après lui par la même issue, il s'abandonna à la mort qu'il croyoit inévitable; mais le tonnerre sans lui faire aucun mal passa devant ses yeux & entra par le guichet de la grande porte. Alors on entendit un bruit pareil à celui du canon ou d'une bombe qui creve; la cloche cessa de sonner dans le même tems; l'Eglise & la tour parurent en feu, & ce fut un fracas épouvantable de tuiles & de morceaux de bois qui voloient de tous côtés.

L'homme qui étoit dans le porche n'espéra presque plus rien; & voulant mourir au pied de l'autel, il prit la résolution d'entrer dans l'Eglise, quoiqu'il entendit le tonnerre gronder encore & fracasser le haut de la voûte. Dès les premiers pas qu'il fit, il se trouva au milieu de quatre cadavres & environné d'éclairs & d'une épaisse fumée; il regarda à droite & à gauche & vit à sa droite son Curé étendu le visage contre terre; à sa gauche & dans la même

la moitié de ses cheveux roides & redressés, & l'autre moitié dans son état naturel. On n'a remarqué aucune blessure au corps de la mere du Curé, & pour les deux autres on n'en parle point dans le Mémoire qui m'a fourni cet article.

from Nouveau choix de pièces
tirées des anciens
Mercures, et des autres
journaux. par
M. MARMONTEL. tome XXV
Paris, chez Rollin et al.
1759 (?)

[Pierre Lagrange]

bol 0049

"KNOWLEDGE" - September, 1913

Knowledge.

With which is incorporated Hardwicke's Science Gossip, and the Illustrated Scientific News.

A Monthly Record of Science.

Conducted by Wilfred Mark Webb, F.L.S., and E. S. Grew, M.A.

SEPTEMBER, 1913.

THE EXISTENCE OF LUMINOUS BIRDS.*

By COUNT L. de SIBOUR.

FEW students delve deeply in natural history without encountering the topic of luminous birds, and the pros and cons of the subject are developed by the reader with a frequency that tests the credulity of any superficial investigator. That birds having the quality of luminosity have long existed seems a fact beyond dispute. Especially true is this in England. In 1907 Sir Digby Piggott called the attention of ornithologists to the appearance of luminous birds in Cambridge, and these unusual members of the feathered family had already been noticed by others in the same county, and especially by Mr. J. H. Gurney, of Norwich, who spread the news on the Continent through the French ornithologist, M. Ternier, in *The Ornithological Review of France*.

It seems that as early as 1866, in the same county, Mr. J. A. Harvie-Brown had mentioned "moving lights" frequently seen at night. But no special attention had been paid to these reports, as they were believed to have originated in the credulous minds of country folk.

The more frequent apparitions in 1907 at last aroused the attention of naturalists, especially in France, where similar cases had been observed in the Vosges and in the Pyrenees.

According to Sir Digby Piggott, a couple of luminous birds were seen near Twiford, Norfolk, in February, 1907, by a gamekeeper, who, having killed one, identified it as a common barn owl (*Strix flammea*). In October, 1907, Mr. B. J. Purdy and Mr. Spencer saw another which was seen again on

the 19th and 22nd of December. On the first occasion it seemed to have attained the maximum of luminosity, as the branches of the tree upon which it had perched were visible in the pale yellow glow. This light did not frighten the mice; for the bird was seen to drop upon them several times.

The power of the light was that of a bicycle lamp seen three or four hundred yards off, and its strength diminished considerably when the bird's flight was in a direction away from the observer. This pointed to the inference that the luminosity was confined to the breast.

According to Mr. C. L. Harman, a luminous bird was seen by him in the marshes of Haddiscoe, on the 25th day of December, 1907. Similar apparitions were recorded during the years 1907 and 1908; but in 1909 they ceased, and none has since been observed.

The glow on the breast of the barn owl is undoubtedly due to phosphorescence, and the moulting of the feathers explains its sudden extinction.

Two theories were given as to the origin of this unusual luminosity.

Mr. Gurney, who had the opportunity of observing several specimens of these birds, thought it probable that the owls had been in contact with phosphorescent wood, and that phosphorescent bacteria had attached themselves to the feathers. This opinion at first was generally accepted, especially in Norfolk, where many birds had been seen, and was apparently confirmed when Lord Lindley announced that on his property there was a

*Extracted from Articles by L. Ternier, in *The Ornithological Review of France*.

[Dave CLARKE]

beech tree showing a patch of phosphorescence eight inches square. It was therefore surmised that the birds had inhabited holes infested by this bacterium. The other theory was that dampness and uncleanness of the covering of the breast had favoured a sudden growth of luminous fungi peculiar to feathers. This explanation appears to have been more plausible; for in the contact theory it would seem that the wings and head, rather than the breast, would be likely to touch the sides of the hole. Yet these parts produced little or no light. Again, it would necessitate the bird being a tree-hole dweller, whereas similar cases have been observed on Canadian blue herons, for which this kind of life is impossible.

The phenomenon is not confined strictly to wild birds. Cases are also found among domestic pigeons. The locating of the light on the breast can be explained by the fact that the feathers are finer and thicker on that part of the body than on any other, except the neck. It is also a part that the bird cannot thoroughly clean, and will therefore retain the greater part of the germs and dust gathered in flight. The peculiar increase of light during flight is probably due to a chemical action of the air producing superoxygenation, as it is well known that the agitation of a medium containing phosphorescent particles intensifies the luminosity of the latter.

The balance of argument is thus in favour of the fungi theory, and the latest observations of Señor Elorza in Spain are a confirmation of it. On several nights he saw a couple of luminous birds. Upon inquiry he was informed that they had been noticed for several years, that they lived in cliffs near by, and that they disappeared in the month of May. The description given by him did not answer to that of the Barn Owl, and it is to be supposed that we are in presence of another bird, one of nocturnal habits, offering a similar case of phosphorescence. These specimens did not live in trees, but in cliff-holes. Their disappearance in May is accounted for, as in the other cases, by the spring moulting of the feathers.

It might be of interest to look back to the works of the earlier naturalists and note that several

observers were aware of the existence of luminous birds. The first to record their appearance was Pliny. He mentions them in his account of the Hercynian forest (*"Historia Mundi,"* X, 47). Two hundred years later Solin, in the twentieth chapter of his *"Polyhistoria,"* alludes in much the same way to what the great Latin naturalist had observed: *"Soltus Hercynius aves gignit, quarum pinnae per obscurum emicant et interlucent, quamvis densa nox denset tenebras."* It is probable that he was not unacquainted with Pliny's works.

The first work solely devoted to luminous animals was written in 1555 by Conrad Gessner: *"De raribus et admirandis herbis, quae sive quod noctu luceant, sive quod alias ob causas lunariae nominantur, et obiter de aliis etiam rebus, quae in tenebris lucent."* He speaks of plants and grass shining at night, and seems to have an obscure idea of the origin of this phenomenon, which he calls *"res naturae luscentes."*

Finally, in 1647, Thomas Bartholin published his great work, *"De luce animalium."* This is a compilation, in three volumes, of observed (and some problematical) cases of luminous animals. The third book is entirely devoted to birds, and in it are mentioned the Phoenix, the birds of Diomedes, the *"Incendiaria avis,"* which set on fire any tree or house on which it perched; the cock *"cum luce consensum alit,"* whose feathers had robbed from the sun their brilliant metallic shine.

But among these quaint beliefs one finds observations very probably true. In 1641, at Montpellier, in France, during a short period of famine, many fowls were brought to market. Several of these birds attracted wide attention by their unmistakable phosphorescence, and Henri de Bourbon, Prince de Condé, was called to admire them. A cock was killed *"who shone on all parts of his body with a remarkably strong light,"* *"veram totius corporis lucem . . . aperte exserint."* The same year, at Montebello, according to the author, there was a hen which *"shone like a ball of white fire."* And Thomas Bartholin, comparing these two birds, ingeniously adds: *"It is a pity that the cock did not meet the hen; for we might then have obtained a breed of incandescent fowls."*

bol 0050

Phantasmagoria or Unusual Observations in the Atmosphere*

URNER LIDDEL

Bendix Aviation Corporation, Detroit, Michigan

(Received December 22, 1952)

For many eras in man's history, the sky has been occupied by various gods, or constellations, or birds, mythical or real. A new concept has arisen in the last few years, largely a product of aviation and balloony, and civil air defense spotters. In general the reports have more psychological than physical significance. However, certain optical phenomena are now gaining far wider interest than among research men in optics. Some "authentic reports" by "reliable, competent observers" are recounted and considered. While complete interpretation of all "reports" is impossible, due to lack of sufficient experimental data, NO evidence exists for any phenomena not explicable by standard physical concepts.

IT is most unfortunate that man's early activities are not properly recorded for posterity. Thus it is not known when man first became aware of unusual phenomena in the atmosphere. The fear of solar and lunar eclipses was almost universally prevalent until very modern times. Gods in general inhabited the atmosphere—but not in visible form. Unusual birds appear in various myths and may have had some basis for reality in pterodactyls and other large avia. Rainbows have played a prominent part in various stories. As well as we understand lightning today, it is not generally realized that this knowledge has been accepted by the people for only slightly over a hundred years. Benjamin Franklin was greatly exasperated by the loss of life and property which continued even after widespread publication of his experiments. In particular, many churches were being destroyed by fire caused by lightning hitting the steeple. In addition, the bell ringers were being killed by lightning traveling down the wet bell cord. A papal edict had previously been issued that church bells were to be tolled during thunderstorms. This edict was the result of a theory that thunder (and thus storms) could be warded off by countering the noise with the peal of the church bells. The edict was, of course, rescinded, but only about 150 years ago.

* At the time this paper was prepared, the nation was in the throes of a flying saucer scare, apparently of greater magnitude than any previous one. Since the impact was so great, it was believed most worth while to take any action which might alleviate the hysteria. In this spirit, the invitation to present this paper was accepted.

The origin of the general concept now known as flying saucers is difficult to ascertain. It seems that the name was attached to a newspaper report of mysterious objects seen in 1947 and has continued in prevalent use. However, many unusual phenomena were noted in the atmosphere prior to this time. Perhaps the best known is the Star of Bethlehem. In very early American history, a great explorer, David Thompson, who preceded Lewis and Clarke, records in his narrative dated November, 1792, an occurrence on Landing Lake in the Northwest Territory. He observed something which appeared globular and which, he said, from its size must have had some weight. It had no tail and no luminous sparks came from it until dashed to pieces. He assumed that it was a meteor, since he wrote, "The next morning we went to see what marks the meteor had made on the ice but could not discover that a single particle was marked or removed."

Lieutenant Bassett, U. S. Navy, published a book in 1885 entitled *Legends and Superstitions of the Sea and of Sailors*. Even at this early date he stated: "There is an obvious tendency in the human mind to exaggerate wonders. This has been especially true with regard to those wonders found in the great ocean, where a limitless horizon sets no bounds to thought, and where the smallest object, often by atmospheric causes, will easily be magnified." Remember this was written 67 years ago!

He goes on to recount: "The occasional reflections of mountains, cities, or ships in mirage or fog-bank, the land-look of such banks themselves, coupled with

the superstition of the medieval mariner, doubtless gave rise to the many stories of mysterious lands at various places and times. The Chinese call the mirage the "Sea Market."

The quotation continues: "A particularly apt illustration of the effects of natural causes is given in a modern book of travels. One evening travelers in a ship approaching close to Port Danger, on the South African coast, beheld a well-known English man-of-war, a short distance away. The travelers saw faces on board, and a boat was lowered and manned from the English ship, in sight of everybody. All recognized 'Barracouta,' and they expected to find her at anchor when they arrived, a short time after. It was a week, however, before she arrived, and then it was learned that she was at least 300 miles from Port Danger at the time referred to. The image seen was doubtless due to reflection or refraction in some cloud or fog-bank. Arctic voyagers often speak of the very remarkable effects of refraction, and many of the nautical tales of phantom-ships are, beyond doubt, caused by the sight of images in cloud of fog-bank." This excerpt is quoted at great length since, if the incident had occurred today, it would undoubtedly have been headline material. Also, it shows that the physical explanation was obvious even sixty-seven years ago.

I cannot resist the comment that a great deal of the furor of flying saucers is due to the hucksters of science. Pseudo science, uninhibited by the discipline of organized thinking or experimental facts, has received great impetus in the last several years from increased public interest in science itself. This is a lucrative business. It is practiced not only among those who have had some (and, in rare instances, for amusement, among those who have had extensive) scientific training. Those who make a living by such means are the first and loudest to object to a rational scientific explanation of these phenomena. Reputable journalists, too, must feed the maw of our great public press. The dearth of news following the political conventions provided an excellent opportunity for the July epidemic of front page stories.

In trying to analyze the various reports of atmospheric phenomena, one is generally confronted in press reports with two classes of observers: "outstanding scientists" and "competent observers." No aviator wishes to be called an "incompetent observer." Some have been flying for more than 20 years and are most vehement in defense of their ability to observe. Aviation psychologists, however, are well aware of the difficulties pilots encounter in their activities. Many aviators with thousands of hours experience have confided to me some of their difficulties. In flight formation, they have wandered off course following a star instead of the plane in front. Ground lights appear in unusual configurations. The engineer's awareness of these difficulties is evidenced by the plethora of instruments on the pilot's panel. Self-hypnosis is not unique to

aviation; highway engineers are greatly concerned about it in the construction of super-highways.

Concerning "outstanding scientists" I am reluctant to comment. If correctly quoted, their statements have certainly been more "outstanding" than "scientific." I recall one "outstanding scientist," widely quoted in the press, who retained a plainly marked piece of Navy scientific cosmic-ray equipment for several days, then turned it over to the Federal Bureau of Investigation as a "mysterious object," after appropriate interviews with press representatives. Fortunately, the Navy's liaison with the FBI permitted immediate return of the apparatus to its owner.

Several reports have received more widespread interest than others and should be discussed. The "Mantell" case, the Air Force officer who flew to his death in pursuit of a "saucer," has been widely and variously reported. He could have been chasing Venus, he could have chased a cosmic-ray balloon at 100 000-foot elevation (thus visible perhaps for 200 miles). Since Mantell and the others were not familiar with large objects at such altitudes, it is understandable that they would think the object was traveling away from them since they could not close the range. Suffice it to say he was not killed by a mysterious object.

A more scientific report is the "Chiles-Whitted" incident. These Eastern Airline pilots were flying a DC-3 over Georgia at approximately 3:00 A.M. in July, 1948. They saw "a wingless aircraft," approximately 100 feet long, with lighted windows. They veered course and it followed, then it disappeared in the clouds above. With these meager experimental data, the following explanation is possible. It is seldom pointed out that this was a clear, bright, moonlit night. Reflection of moonlight from the aluminum of the plane, and brighter reflection from the plastic windows, provided ample illumination to give a source for reflection from adjacent incipient clouds. It has not been widely known that haze particles too small to appear as solid clouds can act as reflecting layers. To the dark-adapted eyes of the pilots, the reflection appeared brilliant. Being a side reflection, the aircraft appeared wingless. Since the reflecting surface was not plane, the apparent speed and size of the image could be anything. The bright orange object was the reflection of the red hot exhaust pipes of the engines.

Another widely publicized report was from Fargo, North Dakota. Here an experienced pilot in an Air Force fighter plane chased a mysterious lighted object for some time. The object performed variously, always eluding the pilot, but always rising. The report is entirely compatible with the statement that he was chasing a standard meteorological balloon regularly released from airports. In fact, it has been reported that another pilot has chased a weather balloon in daylight when it was fully visible and he duplicated entirely the phenomena reported.

The public press is continually asking for the answer to

flying saucers. The only singular answer possible is that they are the result of physical optical phenomena. But certainly more than one principle is applicable. Analysis of the myriad reports of "saucers" shows that they fall into several categories. One immediately discards the phantasies such as children burned by flying saucers in their own backyards. Many reports come under the category of range and identification errors. Typical of the identification errors was the gossamer debris of a supposed saucer found in southern California. It turned out, on analysis, to be spider web of unusual variety having considerable length and volume. The web had been wind blown a hundred miles or so from its origin in northern California.

People are reluctant to admit range errors. No sea-going sailor will admit he cannot guess range and speed of distant ships. He is usually right because he knows the *size* of the target ship and hence can guess by the stadimeter principle of triangulation. In other instances, he is lost. Typical of range errors are two examples cited in a recent article in *Life Magazine* (March, 1952). In one instance the reporter gives a dimension visually measured as 136 feet at a range of 20 miles; in another, the object was measured as 160 feet long and 65 feet wide, also at 20 miles. Since an object 100 feet long subtends roughly an angle of 4 minutes of arc at 20 miles, and since physiologists say the human eye can barely resolve $\frac{1}{2}$ minute of arc, these estimates appear to be more precisely stated than warranted. In fact, if such estimates were possible, the Navy could save the taxpayers a great deal of money by eliminating range finders from their ships. Thousands of dollars are expended for even a fifteen-foot range finder such as goes on destroyers.

Another physiological principle often neglected is that bright objects appear larger than dark objects. Many reports at dusk or night of large objects could very well be small. It is often published that even physicists at Los Alamos have observed these unusual phenomena—implying *large* unknown objects. The Los Alamos fellows have told me that what they have seen are star-type lights, to be sure, sometimes of fractional magnitude and sometimes with large apparent velocities. But all can be explained as meteors, although they are reluctant to do so. One of the arguments advanced against the meteor theory is that the light lasts a long time and that meteors disappear rapidly. It is often forgotten that oxygen and nitrogen have metastable states and that meteor trails may be visible from the afterglow of the ionized air generated by the meteor, for considerable periods of time after the meteorite has disappeared.

Another phenomenon neglected by the layman in interpreting unusual sights is the mirage. It is too often assumed that these occur only over deserts and in the vicinity of oases. Thermal gradients occur in the atmosphere in widespread fashion. Meteorologists tell me there is a fairly abrupt change in character of the

atmosphere at that point in the thermal gradient where the temperature is 0°C, generally around 8000 feet elevation in the summer. This provides, then, a very good reflecting surface, so that, under proper conditions, one may see ground lights invisible by direct views. The other aspect of this is that the gradient may be in a vertical plane instead of a horizontal one—although this is admittedly much rarer. The presence of strong thermals is known to all aviators who fly over deserts. The "experienced observers" who saw a saucer chasing a Skyhook balloon in New Mexico were likely seeing reflections of the balloon on the vertical thermal gradient plane.

It is obvious, of course, that these boundary layers, so to speak, are fluid just as a surface of water. Minor changes in pressure or other disturbances can cause wave motion, which in turn gives an apparent motion to the image. This motion can have any velocity and hence cause the reports of speeds of thousands of miles per hour.

Rayleigh's law of scattering is familiar to all. This, however, applies to particles small compared to the wavelength of light. When particles are essentially equal in diameter to wavelengths in the visible region, it is possible to have considerable reflection and transmission, similar to the half-silvered mirror. Thus pilots or ground observers can see reflections of lights as well as transmission, and get the impression that some object intervenes. These partial "cloud" formations are sometimes short-lived, and may move with pressure gradients rather than as material—hence unusual motions may be observed. It is also obvious that if you penetrate this cloud the image will disappear. It is as futile to chase these images as to get to the bottom of the rainbow wherein lies the mythical pot of gold.

It is often surprising how slowly information travels. Many times during the war radar operators reported targets that pilots could not find—nor lookouts see. In one instance, for example, many thousands of rounds of ammunition were expended against a radar target consisting of thin air. The phenomenon has been re-discovered dozens of times—yet the general public and often "competent radar operators" are misled by these false targets. Because radar is supposed to show "real" targets, many news writers and pseudo scientists assume that a radar blip is proof of the presence of a *solid* object in the air. Much of the *Life Magazine* article last March (1952) contained glib assumptions that things seen were solid. I wonder what the same observers think of rainbows and sunbeams.

There was much excitement last July by reports from airport control operators that flying saucers were seen over Washington, D. C. Air Defense jet planes dispatched to intercept these targets failed to catch them. The excitement was heightened by visual sighting of targets contemporaneously with radar sighting. Finally, the peak of excitement occurred with the simultaneous visual sighting and radar detection of an apparent

object. Even the astute editor of the *Washington Post* drew the obvious conclusion that real objects were in the sky. It will take some time to educate the laymen to understand that the atmospheric condition which leads to radar reflection may also be appropriate for visual reflection of ground lights.

This education is now beginning. It was reported in the *New York Times*, September 3, 1952, that two pilots "flew through a target showing on the (radar) scope and there was nothing there—not even a cloud."

The austere and generally critical *New Yorker Magazine* has recently published an article signed by David Lang on "Something in the Sky." This is the longest article on a single subject that I have noted in their publication in some time. It is in general a critical article, but forcefully implies that there is still a "secret." It ends with the statement that: "Too many people are waiting for the answer." The only singular answer is that these are displays of natural phenomena not generally understood. Why don't we believe that the aurora borealis is a series of fantastic searchlights projected by an unknown enemy? The excitement over green fireballs displays an equal ignorance of meteors. To be sure, copper and nickel meteors are rare, but not unknown. The expenditure of a sizeable sum of money by the Air Force for special spectrographic cameras will resolve whether the meteors are nickel or copper, but little else. Theodolite measurements will, of course, continue to be important when properly used.

The notorious picture by a Coast Guardsman showing an "echelon" of flying disks was widely published by the press. Only the thorough *New York Times* pointed out that the picture was taken through a window screen—an elementary experiment in diffraction.

One is reminded of the excitement in the early 1900's generated by the N-ray. This was propounded by a Parisian "scientist" (by present press standards a world-renowned, outstanding scientist). These rays would penetrate all matter, yet could be diffracted by a special prism. This hoax, you will recall, was exposed by R. W. Wood, to the dismay of some people, but the delight of those who believed in the rationale of physical optics.

One recalls the incident of the two employees of the Empire State Building who were on the observation tower one evening. They were extremely frightened by an image of a large head and torso in the sky. Rational thinking prevailed and they soon observed that it was their own shadow cast on a cloud formation.

The United States, in acquiring its leadership in world affairs, has also acquired a virtual monopoly on flying saucers. In addition, the concentration of reports centers around areas involving Atomic Energy Commission activities. This implies intelligence on the part of the people controlling the saucers. It also contributes to the mass hysteria prevalent at this time. We are conditioned to be frightened of atomic weapons and the great secrecy surrounding them. Thus, just as ghosts are seldom seen outside cemeteries or haunted houses, so flying saucers are seen at points of greatest fear psychosis.

Gullibility of people works two ways. After the publication of an interview I gave a couple of years ago, I received a letter from southern France expressing great appreciation for the explanation of sights seen there. It contained a beautiful colored drawing of these objects—including landscape; they were balloons with drop lines and baskets of the type seen often in French illustrations. They could not have been skyhook balloons or similar objects.

I have no delusions that all "explanations" which may be given will stop the flood of saucer stories. They are but facets of the mythology of this stage of history. People believe what they want to believe—not necessarily what is true. The general public has not been able to keep pace with the advance of science. Since so many apparent miracles, such as radio and television and use of nuclear energy, have come to pass, the laymen will believe most any story. The success of various comic strips also bears witness to this.

It can, however, be categorically stated that I know of NO evidence which leads one to doubt the physical laws of motion and inertia or to believe in inter-planetary travel at this time. All reliably reported incidents can be fully explained when sufficient scientific data are provided. Most of the incidents are the result of one or more of the following: (1) reflection (visible or radar), (2) refraction, (3) meteors and meteor trails, and (4) diffraction. Pressure, temperature, and moisture gradients are widely prevalent in the atmosphere and provide interfaces for the action of these optical principles. Meteorologists readily admit how much they need to learn. The extensive effort now being expended on compiling data may be worth while after all, by providing information leading to a better knowledge of the atmosphere. It may indeed be important in our present defense effort for other reasons.

[T. PINVIDIC]

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From THE GHOST BOOK by Alistair Alpin McGregor p. 202-224 (195)

CHAPTER XVI

PHANTOM LIGHTS

ONE evening not so long ago, an Edinburgh doctor, while staying at the inn at Broadford, in the Isle of Skye, sauntered out for a stroll after supper. Arriving at the shore, he noticed a bright light far out in the bay. This he at first took to be a flare lit by the Skye fishermen then operating in these waters. Soon he began to realise, however, that the light was approaching, with great smoothness and regularity of speed, the spot at which he was standing. His description of it was that it resembled a globe of light—a light such as one might see hanging from a lamp-standard in a modern city. No sooner had the light reached the tide's edge than it went out. In its place the doctor now saw, for a brief moment, a cloaked woman clutching an infant. She hurried across the sands in front of him. In an instant she, too, was gone.

The doctor, on his return to the inn, enquired of its keeper whether he knew anything which might have accounted for what he swore he had seen. Several years previously, the innkeeper now told him, when a ship was wrecked offshore in Broadford Bay, a dead woman and a dead child had been cast ashore at the spot he had defined.

I was among the first to hear of this ghost light, for I was busily engaged in Skye at the time, gathering material for a book on that fascinating Isle. The doctor who witnessed it was one of the sanest of men, not the least given to Celtic Fantasy, but maintaining with so many of his profession an open mind as to the explanation for such occurrences.

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It is said that, both in the Rannoch and in the Breadalbain regions of Perthshire, the phenomenon which the Gaels term the *gealbhan*, or ball of fire, has sometimes been seen. People dwelling by Loch Rannoch-side have told me of the strange light in the form of a ball which at times skims a particular stretch of the loch's surface.

202

[BOB SKINNER]

Breadalbain's best known Ghost Lights are perhaps the two reputed to have been seen simultaneously on Loch Tay some years ago.

When the little farm of Morenish, on Loch Tay-side, was occupied by a family named Cameron, and the eldest son was serving abroad with the army, two of the younger sons died of the fever. They were buried in the kirkyard at Kenmore, which is situated at the eastern end of Loch Tay. For some reason or other, the eldest son thought that his brothers ought to have been buried at Killin, at the loch's *western* end. When he came home on leave, therefore, he arranged to have their coffins exhumed, and conveyed by water to Killin, for re-burial there, some fifteen miles from Kenmore.

An old man whom I met in this locality about 1935 was one of many who declared that, on the night before the re-interment, they had seen two bright balls of fire speeding along the surface of Loch Tay, on a course which the next day the boat carrying the coffins actually followed.

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Early in the present century, and indeed for some years previously, two Corpse Candles (the name given in Celtic lands to supernatural lights or tongues of flame in the shape of a candle) were frequently seen at Taagan, a tiny township at the head of Loch Maree, in Wester Ross. This type of manifestation, to which there are so many references in the literature of the Celtic countryside, is believed to be a forewarning of death, imminent or almost so.

The case of the Corpse Candles at Taagan is interesting in that a period of years elapsed between the time of their first appearance and the date on which there occurred anything tragic. Eventually, in the Holly Pool, where the Corpse Candles had been observed so often, two Taagan children were drowned when making for an adjoining harvest-field.

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In no part of Britain may the cautious enquirer learn more readily of supernatural happenings than in Wester Ross, and in those rugged, coastal regions of Sutherland situated to the north of it. Gairloch, Loch Maree, Poolewe, Loch Ewe,

Gruinard, Loch Broom, Ullapool, Coigach, Assynt, right up to Cape Wrath, in the extreme northwest of Scotland—every one of these localities has its phantoms in one form or another. Indeed, one would be surprised to learn that such phenomena as unexplained lights are unknown in any of them.

The other day I received from Jack Harrison, a friend living at Ythanbank, in Aberdeenshire, an account of such a light in the Gruinard district of Wester Ross. Jack knows intimately these remote but supremely lovely regions, having managed the Lochcarron estate for Charles Murray until the latter's death in 1945. "No doubt you will have the One-Inch Ordnance Survey Map, Sheet No. 19—Ullapool and Loch Ewe," he writes me in that precise way in which the Scots, in matters of correspondence, are perhaps preëminent. "You will find 'School' marked on the map between the 10th & 11th mile-stones, on the road between Little Gruinard & Gruinard House. On the bay is an islet, or, rather, a big rock, marked Fraoch Eilean Mor."

According to Jack's friend, Hector MacLeod, whose family resides at Little Gruinard, by the shores of the loch of the same name, he and other natives, on several occasions, have seen quite clearly a strange light becoming visible as far away as the township of Coast, and have watched it as it travelled slowly from the heights above the road toward the islet Jack refers to. There it always disappears suddenly. Hector, I am assured, is not unduly superstitious, certainly not in the Wester Ross sense. Yet, he speaks with such moderation and assurance of his having seen this light that even the most sceptical listener must feel loth to doubt him. The light's peculiarity, he tells me (and, incidentally, other eye-witnesses bear him out in this), is that it resembles a ball of light *without rays*.

Among those testifying to the authenticity of Hector MacLeod's account is his cousin, John Gunn, Sir Alexander Gibb's ploughman at Gruinard. Gunn, who lives at the township of Sand, and cycles daily the road between his home and Gruinard House, has often observed the light descend to travel in the direction of the islet. More than once it has passed so close to him as to have created a strange noise in his ears. But what puzzles him more than anything else about it is the total absence of rays.

The light's appearance is not associated in the minds of the local people with any particular happening, though it would seem to occasion amongst them a certain uneasiness.

In 1930, when Gibb was carrying out some major alterations on Gruinard House, an English lass, who at the time was the late Lady Gibb's lady's-maid, committed suicide at this islet, a few days before the arrival of the house-party. Hector MacLeod was then serving his apprenticeship as a gardener at Gruinard House; and he recalls distinctly how, immediately after this fatality, one of the workmen, who came each day from Aultbea, told his mates that he had been seeing the light regularly for some days, and had twice passed on the road a phantom funeral. In their minds they now associated these manifestations with the maid's suicide. Not for some months after this tragedy was the ghostly light seen again.

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An authority on the folk-lore of Wester Ross read before the Gaelic Society of Inverness some years ago a learned paper containing several references to Ghost Lights. One of these was the light reported from time to time in Upper Loch Torridon, and believed to be based on Ob Mheallaidh, an enclosed bay on the south side of the loch, not far from the village of Shildaig. The light, when stationary, resembles that carried on the foremast of a ship riding at anchor in the dark. Those sceptics who do not know Torridonian waters pronounce it to be such a light, but offer no explanation when told that it is sometimes seen moving rapidly from its base toward the head of the loch, and on a course which even a small vessel could not adopt.

This light is often seen by the inhabitants of Wester Alligin and Inver Alligin, two crofting townships situated on the north side of Upper Loch Torridon. No fewer than seven people dwelling by the northern shore are said to have witnessed it simultaneously on one occasion, as it emerged after dusk from Ob Mheallaidh, some three miles away.

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Of the many accounts of Ghost Lights I have heard, one of the most interesting is that related to me by the Rev. Murdo

MacDonald, minister of the Argyllshire parish of Killean and Kilchenzie. In Carloway, that district of the Island of Lewis to which Mr MacDonald belongs, one frequently hears reference to a weird, supernatural manifestation alluded to locally as the Ghost of Bearnn Eile. An Irish pedlar, touring the Outer Hebrides with his wares about the middle of the eighteenth century, was benighted at Doune, the remote township in western Lewis where stands the famous Broch. Uncertain as to how to proceed to Carloway village, situated about two miles away, he called at a house in Doune Mor to ask for guidance. The man of the house, surmising that the pedlar had money on his person, offered to conduct him by a shortcut. Before doing so, however, he armed himself with a hammer. This he secreted in his clothing. Midway between the villages of Doune and Carloway, and at a place called Bearnn Eile, he foully murdered the pedlar. Local tradition has it that he then carried his victim's corpse a distance of about two hundred yards, that he might bury it easily in soft, peaty ground. Conscience-stricken and much afraid, he afterwards hid, in or near a well in the neighbourhood, such money as he had robbed him of.

For generations, the local people had been seeing, at night, a light travelling from the spot beneath which the Irish pedlar's body was supposed to lie, and the old, unused well, where the money was believed to have been deposited.

In 1922, three of Mr MacDonald's young cousins, each of whom, time and again, had watched the light as it travelled toward the old well, suddenly to vanish there, dug up the ground round the well. There they found a sealskin purse containing a number of Irish pennies, the dates on most of which were by now undecipherable. Note, however, that three of them bore distinctly the dates, 1740, 1743, and 1744.

Such is the story of the murdered pedlar, to whose buried purse a phantom light had guided Murdo MacDonald's cousins. Since the recovery of the coins, the travelling light has not been seen.

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Fairly recently, a strange light was observed in Loch Carloway. A decade or so ago, there lay at anchor in this quiet

fiord a 25-foot motor-boat which, until some of the Carloway crofters stated that on several occasions they had seen a weird light hovering about it, had been used for fishing purposes. Thereafter the owner could not persuade any of the local lads to go fishing with him aboard her, since such lights seen at night are regarded by the Hebrideans as a certain prognostication of fatality. A few years ago, one could have purchased this splendid craft for the proverbial song.

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Kenneth MacDonald, a native of the maritime village of Sandwick, situated on the outskirts of Stornoway, tells me of an uncanny light he himself saw when a boy of twelve. Four contemporaries were playing with him on the adjacent peat-moss when they came upon a log—an unusual object in an island so treeless and barren as Lewis, except when storms cast timber ashore. The log the boys proceeded to move toward a pool in the hope that it might float thereon at least one of them. When on the point of pushing it over the bank and into the water, a huge light flared on the marshy ground no more than a dozen feet away.

Will o' the Wisp, you may say! That's just what I suggested to the intelligent Kenneth, who for many years taught in that celebrated school at Stornoway known as the Nicolson Institute. He ridiculed this explanation, and rightly, I think.

All five boys saw the light; and it so terrified them that they bolted for home. It happened that several of the villagers, busy about their crofts, also saw it. The old folks of Sandwick declared that somebody would be found dead by that peaty pool.

In 1935, a lad the worse of drink lost his way when trying to return from Stornoway to his home at a neighbouring township. He was discovered at this spot, dead from exposure.

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A fellow named Morrison, who also is a native of these parts, relates a weird experience he had when, in company with the son of the farmer at Stoneyfield, he too was returning home one night from Stornoway. The two men were proceeding leisurely in the farmer's trap. Reaching the point on the

Stoneyfield road at which a branch diverts to Holm, Morrison alighted in order to continue along it on foot, since he lived at Holm. The night was clear and calm. He had parted from the farmer's son but a minute when, in casting a glance in the direction of the Stoneyfield road, he noticed a strange light travelling in front of the trap, and at no great distance from it.

On meeting the farmer's son the following day, he enquired of him whether he had seen a light running ahead of him the previous evening, after they had parted. "Did *you* see that light too?" asked his companion. "I certainly saw it; and I whipped the pony as hard as I could in an effort to overtake it. But I could not gain an inch on it. Instead of turning in at Stoneyfield, I drove straight ahead, following it down as far as Holm Farm. I lost sight of it in turning the corner at the byre there."

He went on to say that, late though the hour was, he knocked up the household at the farm to ask whether they knew of anyone abroad, possibly on horseback, with a bright lantern. He was assured that everybody connected with the farm was abed.

A day or two later, the old farmer was drowned in Stornoway harbour. His body was carried home to Holm farm in the Stoneyfield farmer's trap.

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Another instance of a ghost light believed to have been seen as a portent of tragic death belongs to Luing, one of the Slate Islands, situated in the Firth of Lorne.

On a dark night in May, 1890, James Campbell was returning home through the small glen of the island of Luing known locally as Duiletter. Suddenly he saw, some distance ahead of him, a bright light. The light, following the course of the stream running throughout the glen's entire length, was approaching him at a great speed. The rough island road traversing the glen was carried across the stream at several points by as many stone bridges somewhat crudely constructed, but sufficiently strong to bear the weight of a horse and a loaded cart. At one such bridge, within a yard or two of the spot where Campbell stood in astonishment, the advancing light came to rest, and then vanished. Campbell, in relating

the incident to his neighbours, said that the light had awed him, rather than frightened him.

The following morning, when Donald Livingstone, son of a local farmer, was returning astride a horse he had just taken to the island smithy to be shod, this bridge collapsed under them. Rider and mount were thrown into the stream below, the former pinned helplessly under the bulky body of the latter. The stream was blocked. Its waters rose. Donald was drowned.

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Quite recently, a certain Mr R. Millar, residing at Wick, in distant Caithness, told me of a strange occurrence when, as a young man at the turn of the century, he was in the habit of visiting relatives then living in a house situated at the seaward end of the village of Latheronwheel, on the east coast of Caithness. From that end of the village may be obtained an uninterrupted view of a stretch of the public road skirting the coast. About a mile to the westward, this road, in ascending to a bend, disappears behind some high ground, and at a point where the cliffs fall steeply to the sea, some four hundred feet below.

One New Year's time the natives of Latheronwheel were puzzled by a bright, though somewhat diffused, light seen on three or four successive nights at the highest visible point on the road, just where it deflects from sight. At first they thought it to be the lamp of a coach or other vehicle, halted for some reason at this point. But the notion of its being such had soon to be abandoned. No coach ever reached the village thereafter, such as might have explained the light; and, hitherto, no vehicle was ever known to have proceeded toward that spot at the hour when the light was seen. Curiously, the country people looking in the opposite direction—that is to say, looking from west to east—also saw it on the same successive nights, and at this same spot. Nobody could explain it.

The day after the light was seen for the last time, a strenuous storm enveloped a number of boats at sea from the fishing village of Lybster, some six miles to the north-east. Two of the boats were lost with all hands. A sad disaster, such as has been the fate of fisher-folk to suffer from time to time.

With the storm's abatement, men crept along the lofty cliffs'

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edge, peering down to the sea in the hope of locating corpses cast ashore. At a point immediately below the high ground where the mysterious light had been seen, a body was observed in the water, among the rocks. With considerable difficulty, since there was snow on the ground and ice on the cliffs, it was retrieved, and carried up the cliffs in a sheet, to be laid, quite unwittingly, at the precise spot by the roadside where this strange light had been seen. It turned out to be that of a young fisherman from the Lybster district. My informant was among those who assisted in bringing it up the cliffs, and who were not slow to notice just where it had been deposited, awaiting there the vehicle from Lybster which was to convey it to the drowned man's home.

When all this became known to the people of the neighbourhood, they at once 'explained' the light as a supernatural prognostication of what was to befall. Several of them, in earlier years, had seen such lights, and, as they recalled, with calamitous consequences.

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Our mentioning the fisher-folk of Caithness carries the mind's eye southward along the coast to those fishing communities of the Moray Firth and of Aberdeenshire, among whom there lingers many an age-long superstition. The East Coast fishermen, as they are called, so as to distinguish them from the West Coasters, are usually Plymouth Brethren, with a strong bias in favour of the beliefs one associates with their calling. I know these fisher-folk fairly well, having once contested a general election in their midst, and having, in later years, traversed most of that coast leisurely, noting some of their beliefs and customs. Ghost lights are so frequently seen by them that they tend to be regarded as quite ordinary, though perhaps infelicitous, occurrences. Among the better known in this region are those seen in the old churchyard of Gamrie, situated on the cliff-top a mile or two from Gardenstown, in Aberdeenshire. The church itself dates from the fourteenth century. Burials in the churchyard continued until about 1935; and quite often mysterious lights were seen there soon after an interment. The spot is still said to be haunted by phantom lights.

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The natives of Benbecula, one of the most romantic of the Outer Hebrides, claim to have seen many a phantom light, but none more vivid than that witnessed by several of them on an eyot in Loch Olavat, at the north end of Benbecula. This eyot, in springtime the habitat of countless nesting birds, measures no more than forty yards at its greatest length. For several consecutive days during the summer of 1938, this strange light appeared on it. The islanders were convinced that it was a portent of some kind—probably of unexpected death.

That summer, and on the day following the light's last appearance, Mr Swanson, an angler who for many years had gone regularly to Benbecula to fish, was out on Loch Olavat with MacDonald, his gillie. At the luncheon break, and in expectation of locating a swan's nest, he rowed over to the eyot, taking with him MacDonald's daughter. No sooner had he landed thereon than he took a seizure and died.

An entry in the diary of an angling friend of mine, who frequently visits Benbecula—an anglers' paradise—shows that, for some time prior to Mr Swanson's death, his gillie had seen "a glowing fire like a smouldering peat on the little island . . . and there was nothing to account for it".

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Among the weird happenings associated with the shielings in the Highlands and Islands of Scotland in olden times were instances of phantom lights seen at them or in their immediate vicinity, often when they were known to have been unoccupied. The custom of herding the cattle from the township to the moorland pastures at the shieling, and remaining there with them for a few weeks each summer, has died out almost completely. Only in Lewis, I believe, does the shieling, in its true sense, survive. The vast moors of that island, and the limited extent of grazings in the vicinity of the many crofting communities, have perhaps prolonged its precarious existence there, when it has been abandoned elsewhere.

From an isleswoman living at West Calder, and possessing the poetic name of Seonaid Flora MacIver, I obtained the other day the following account of a ghost light seen at a Lewis shieling.

One night in 1938, two men in their early twenties, when poaching on the Barvas moor, saw a bright light at a shieling situated quite alone on a vast stretch of moorland. This they thought very strange, as it wasn't shieling-time, and, in any case, this particular shieling had not been occupied for some years. It occurred to them that, maybe, the shieling was being used by some fellows who, like themselves, were out poaching that night. The light, which was stationary, continued to show as they crept silently toward the turf shelter, but went out when they came within three or four feet of it. Each of the lads carried an electric torch since, even in the remotest parts of the Hebrides nowadays, law-breaking is conducted with the aid of every modern contrivance. They entered the hut to find no trace of anybody, nor of its having been recently occupied. Somewhat bewildered, they began to search with their torches the surface within a radius of fifty yards. So flat was the moorland in the immediate vicinity of the turf dwelling that it would not have afforded cover to a small child.

As the lads were pursuing their investigations some yards away from the turf dwelling, they noticed that its interior had suddenly become lit again. They separated, in order to approach it from opposite angles. Once again, on their coming within a few feet of it, the light went out. Once again they went inside with their torches, without finding anybody, or anything from which the light might have come.

Now greatly fearing, they hastily quitted the scene. They had proceeded but fifty yards when, in halting for a moment to take stock of the situation, they looked back to find that for the third time a light shone brightly in the shieling hutment. Listening intently, they now heard the faint strains of ghostly music issuing from it. They fled home to Barvas, never again to go poaching in that neighbourhood.

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Ghost lights are likewise seen on shieling sites in the neighbouring island of Harris; but none of these would appear to be as persistent as that seen at Leuchcan at irregular intervals during the last half-century. One night in 1944 it was witnessed by several people who, having mistaken it for a signal of some kind, hurried off in its direction. The light vanished before

they could reach the spot. A couple of scientists holidaying in the locality immediately suggested marsh gas. This did not impress the islanders.

A more notable Harris ghost light, however, is that frequently seen to rise from the roof of a house at the township of Manish. About this phenomenon, everybody in Harris knows. Dozens of reliable islanders have seen it. Nobody questions it; and the natives are not slow to reject the various explanations put forward by the scholarly. The house concerned is one of the newer 'white' houses, so called in the Hebrides to distinguish them from the old 'black' houses which preceded them, and which in recent years have been disappearing so rapidly, except from the remoter clachans of Lewis.

This light, now known widely as the Manish Light, became particularly active in 1949, the year a friend of mine paid his first visit to Harris, and lived for some weeks in its locality. That year the light seemed to acquire an unusually brilliant phosphorescence which it has never lost. My friend, who often had occasion to pass the house during the day-time, and occasionally at night, made some discreet enquiries on the spot, regretting the while that he did not speak Gaelic—that he did not have the Gaelic, as the saying is—since the islanders are peculiarly reticent with those who know only English. All he could gather was that the house had been built on ordinary lines, that the family occupying it was normal in every way, and that neither to family nor to house was any exceptional circumstance attached. A school-teacher with a good science degree examined the house recently, but could find no explanation for the light, which he himself had seen on more than one occasion.

* * * * *

One bright summer's day toward the close of last century, John MacArthur, son of an Argyllshire schoolmaster, was standing on the brae behind the schoolhouse at Dunmore, looking across West Loch Tarbert in the direction of the ferry plying between Port a' Chaolain, on the Kintyre side of the loch, and Ardpatrik, on the South Knapdale side. Suddenly he saw a light emerge from the roof of the ferry-house at Port a' Chaolain. This light ascended slowly into the air, and quietly disappeared. It resembled the flame of a candle, tapering at

both ends. "It would be, I should say, about seven feet in height," John tells me. Its distance, as the crow flies, from where he was standing was roughly two-and-a-half miles. The sun shone brightly at the time. Yet, he declares that he saw this phantom light clearly.

Later the same day, MacPhail, the old ferryman, died.

* * * * *

That same year John MacArthur's father, the schoolmaster, saw a Corpse Candle. It was the year in which a laird of Carse, who was a bit queer in the head, wandered down through his estate to Carse Point, which juts out into Loch Stornoway, in Knapdale, there to drown himself. For John MacArthur, as a lad, the spot, naturally, had rather sinister associations. These were in no way lessened by the fact that the half-submerged rocks off Carse Point are known by a Gaelic name signifying the Moaning Rocks.

One midnight John's father, accompanied by his own brother and a fisherman friend, were returning home from fishing at Tiretigan Point, on the Kilberry shore. As the night was unusually dark, the three men got separated from one another. His father, having taken a shortcut to the Tarbert-Kilberry road, stood leaning on a gate by the roadside, waiting for the others to make up on him. In looking across Carse Bay, he saw, to his astonishment, a Corpse Candle proceeding down toward the Point's extremity. It followed the rough pathway threading through bushes, disappeared where trees intervened, and finally emerged to full view again where the path lay open to the shore. At the spot at which the old laird afterwards drowned himself, it vanished.

"It was indeed unfortunate," John MacArthur writes me, "that my father was alone at the time, since there was no one to corroborate his story. The place where he saw the Corpse Candle was far from houses, and no human was in the least likely to be down there at such an hour."

* * * * *

In recent years phantom lights have been seen on several occasions in the Morven district of Argyll, especially in the neighbourhood of Rahoy, a lone and lovely spot on the north

shore of the little inlet of the sea known as Loch Teacuis. Rahoy was the home of Dr. MacLachlan, the bard usually referred to by the Gaels as the Sweet Singer of Rahoy. Incidentally, his Gaelic song extolling the cuckoo was the first I ever knew. In the Highland school of my early boyhood, the day opened with prayers, to be following with a few minutes' slithering up and down the tonic sol-fa (as devised by Sarah Glover and developed by John Curwen) preparatory to twenty minutes with Dr. MacLachlan and his cuckoo.

One midnight in January, 1933, Evelyn Newton and her late husband noticed at Rahoy, their home, a strange light coming toward them. It was travelling along the path known locally as the nut walk, because of the number of hazels fringing it. The light, to begin with, resembled such as might have been given by the rays of a lantern. When it came to a bend in the walk, however, it burst into something vivid and effulgent, as though the rays had suddenly given place to a light resembling a large car's headlamp instantly intensified by depressing the accelerator pedal. A much smaller light now appeared to be travelling abreast of it. Soon both lights were running side by side through the woodland close to the house. As they receded toward the spot where may be seen the remains of the vitrified fort so clearly marked on the O.S. map, they contracted, and eventually disappeared.

The Newtons knew that there was nobody on their side of the loch, and particularly at that hour, who could have been responsible for these strange luminants. In the twenty minutes during which they stood watching them, their performance was repeated half a dozen times. First, the light coming along the nut walk, then the smaller light joining it, as it were, and then both lights dwindling, and finally going out just by the vitrified fort.

When the Newtons mentioned the matter to some of their employees the following morning, they were to learn from their late keeper, John MacDougall, that one night during the previous autumn he, too, had seen such a light. Indeed, he had followed it promptly toward the garden, believing it to have been carried by someone trespassing in the dark in search of fruit. He stalked it, as one might stalk a poacher. When almost within reach of the light, it vanished.

Shortly afterwards Evelyn Newton, accompanied by the same John MacDougall, was returning home at twilight when both of them saw a queer, stationary light high up in a tree in the wood a quarter of a mile or so from her house at Rahoy. "I noticed it first," she told me. "I called John back to look at it. He saw it, quite plainly. He had no explanation to offer. We were both mystified."

* * * * *

In England and in Wales, as in Scotland, these lights, for some reason, are seen most frequently in mountainous country. One immediately recalls in this context the wellknown Pennine Light, which so many claim to have seen. Travellers on the road between Scafton and Witton, in the Leyburn locality of Yorkshire, often see it. Last autumn I met in this neighbourhood a motorist who told me that, in approaching at night a particular stretch of the major road there, he and his motoring friends frequently pull up "to allow the car to get by before turning into the road". Meanwhile, this stretch is brilliantly lit as if by the powerful headlights of a car which never materialises. My informant, who was chary about giving me his name, mentioned that thrice in recent years he had halted in a side-road just there, soon to realise that the light was stationary, and not advancing, as he had expected. On his turning into the major road, it vanished on each occasion.

I have before me the written and signed testimony of Mr William Brown, a contractor at West Scafton. "I have seen the Pennine Light near Scafton, usually [at] Xmas. time," he writes. "A brilliant light something like that of a car. As one gets nearer, it vanishes. It is rather difficult to explain. Could explain better when I see you." Well, one day I may visit Mr Brown at Scafton.

* * * * *

This brings to mind another odd, stationary light—one about which a certain Alasdair Drummond wrote me recently.

In the spring of 1949, when Alasdair was living in Inverness, he went for an evening run in his car in the direction of his beloved Strath Errick, accompanied by a friend. The car he parked at the north end of Loch Duntelchaig, just by the

concrete dam raising the loch's level for the purpose of supplying the town of Inverness with water. It stood with its front facing away from the loch, toward a piece of ground covered with rough heather and birch scrub.

Alasdair and his friend ambled a while by the loch's edge, returning to the car about dusk. While seated side by side in it, peacefully partaking of some sandwiches they had brought with them, the friend observed a strange incandescence a few feet ahead of them. "What's that?" he asked. Alasdair looked up from his place at the steering-wheel to see a strange ball of light. "It looked like a pale, greenish-white, over-sized football hanging in front of the car," he writes me from Killearn, in Stirlingshire, "possibly eight feet in front of the car's bonnet. We both looked at it for a time, as it persisted there."

He now switched on both headlights; but the light, seemingly unsupported, remained stationary. As he stepped out of the car in the hope of examining it at closer range, it began to fade away gradually. Examining the ground round about the car, neither he nor his friend could find anything to account for what they had certainly seen. Nothing was to be found: nor was there anyone else about. Somewhat perturbed, they drove back to Inverness with all speed.

"Admittedly, the whole thing is completely unbelievable. But it did happen," he concludes; "and it happened when I was sober and completely *compos mentis*. I never went back to that particular spot—not in the dark, at any rate!! Feeling rather foolish about the whole thing, I mentioned it to no one until I chanced to see in a Glasgow newspaper your enquiry about a similar sort of occurrence. I then related our experience to my mother and some friends, here in Killearn, and they urged me to write you these details."

"When I lived at Parcyronen, my old home, situated two-and-a-half miles from Carmarthen, the Misses Thomas—Esther and Lilian—whose family then tenanted the neighbouring farm of Llether, once told me that, when a young man, their own father, John Thomas, who died in 1946, had seen *Canwll Corf*, or Corpse Candles." Thus Miss Doris Stephens, a Carmarthen correspondent, wrote me in the spring of 1951.

As my material on Phantom Lights seemed singularly sparse where Wales was concerned, I asked that I might be put in

touch with the Misses Thomas, in the hope of obtaining from them an account of their father's experience. This was immediately forthcoming.

According to it, Farmer Thomas, while employed as a *gwas*, or manservant, early in the present century, was out walking in the fields on a summer's evening with a fellow *gwas*, after their day's work, when he noticed in the dusk, and at some distance, a strange light. To this he drew his companion's attention. The latter, who now saw it too, remarked that it could be no more than phosphorescence—no more than will-o'-the-wisp. Young Thomas pointed out, however, that there lay in its locality no marsh from which such gas could be emanating. They looked again. The light was still to be seen. That they might obtain an uninterrupted view of it, they ascended a bank near at hand. Now afforded a clear view over the intervening hedge, they saw that the light was travelling toward them from the small village of Francis Well, lying in the valley below.

"It looked like a bright candle flame, without the candle; and it kept on coming nearer and nearer to us," was the description young Thomas gave to his daughters. "It passed by us, on the other side of the hedge, just where the footpath came up from the valley. It went on, hopping along a few inches above the ground, and then vanished in the distance."

Three days later, a funeral, on its way to the nearest churchyard, came up that pathway from Francis Well, in the valley below, following for a considerable part of the way the route which the Corpse Candle, as seen by two perfectly sane and sober manservants, had adopted.

This was not the only occasion upon which Farmer Thomas saw warning candlelight. Ten years after this incident, when living with his wife and children at a farm called *Tyrdhu*, or Black House, close to Pibwrlwyd mill-stream, and but a mile and a half from Carmarthen, two of his children fell ill. Seated alone in the kitchen one evening, while his wife was attending to their declining offspring upstairs, he saw "a little light, like a candle flame, come under the front door". It travelled upstairs, hesitated a moment by the children's shoes lying at the stair-head, and then slipped under the door of the bedroom in which they lay. A few seconds later, it descended the stairs to leave the house as it had entered. Farmer Thomas was now

convinced that the children were not to recover. Very soon afterwards, both of them were dead.

Shortly after they were buried, neighbours told the Thomas parents that, on more than one occasion during their children's illness, they had seen a Corpse Candle travel toward their threshold and enter under the door.

This is by no means the only phantom light reported in the locality of Carmarthen in recent years. Not so very long ago, such a light was seen journeying along the country lane linking Llanpumpsaint with Llanllawddog. It, too, disappeared under the door of a cottage which death, likewise, visited almost immediately afterwards. Several of the country folk had observed it cross the narrow footbridge where a stream intersects the lane.

It was while Dr. Alan Macartney was holidaying in the Loch Awe district of Argyll that, in the course of conversation, his host, Donald MacDougall, residing at Willowbank, Kilchrenan, told him of a weird experience which he recalled when the doctor happened to remark that, if the morrow were fine, he thought he and his wife might picnic where the road ends on the western side of Loch Melfort. Donald casually mentioned that Degnish, a distant farm on the seaward side of the loch, had the reputation of being haunted, and that he himself had had an eerie experience thereabouts when employed as a young man at Ardmaddy Castle.

One evening in 1930, he was returning to the Home Farm after dark. By the side of the road he took ran a burn—presumably that known to the Gaels of Argyll as the Eas nan Ccardach. At an angle in the road, states Donald (and, indeed, as I myself am aware), there is a standing-stone not marked on the One-Inch O.S. map. When he reached this stone, he saw, some distance ahead, a light. It was moving across a field, following the path to the farm which he himself would shortly be taking. He assumed it to be the bicycle-light of his fellow-labourer, the byre-man, homeward bound, like himself, in the dark, leisurely wheeling his bicycle along the path. He tried, but without success, to make up on him. Suddenly the light went out. The byre-man, he presumed, had now reached the farmhouse.

Some minutes after he himself had arrived there, he had

occasion to seek out the byre-man. To his astonishment, he was told that the byre-man had not yet returned! Donald was absolutely certain he had seen him—seen, at any rate, the light of his bicycle-lamp as he wheeled the vehicle in the dark, some distance ahead. The light had disappeared quite close to the farmhouse; and he had every reason to suppose that the cyclist was within.

Donald MacDougall was now informed of his being by no means the first to have seen a phenomenal light following that path.

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Were it not for the aforesaid Dr. Alan Macartney, I would have omitted to mention the round ball of fire seen issuing from haunted Callert House, situated on the north shore of Loch Leven, in Invernessshire. Alan happened to tell me recently that a certain Duncan MacColl, a native of Achtriochtan, in Glen Coe, who officiates at the petrol-pump he patronises when motoring in those parts, declared categorically that he had seen this phantom light oftener than he could remember. Indeed, among the villagers of Ballachulish, on the Argyllshire side of the loch, it is quite a commonplace.

I myself first heard of it through two men, both of whom had had a good deal to do with this part of the country, and had taken a keen interest in all that concerned it. Neither of them was the superstitious and unregulated sort of fellow to whom the sceptics are swift to attribute the origin and currency of any report outwith their own immediate experience or comprehension. There was nothing of the neurotic, emotional visionary about either of them. On the contrary, both were scientists of considerable achievement and repute.

The younger of them was the late Hugh G. MacColl, chief chemist at the Kinlochleven works of the British Aluminium Company. It was indeed a tragedy for the Highlands that in 1947, at the age of forty-five, this exceptional fellow—this devout student of all that pertained to the Clan MacColl, and to Appin, its particular province—should have lost his life at Sürling in a motor-bicycle accident. Though he had never actually witnessed the Callert Light himself, several of his colleagues, all of them senior officials of the British Aluminium Company, had done so, some of them on more than one

occasion. Hugh took the trouble to put on record their accounts of this phenomenon which, they were agreed, took the form of a sphere like a large football, issuing from a certain window in Callert House, and travelling horizontally above the surface of Loch Leven before dropping into the water to extinguish itself.

My other informant was Hugh's close friend and namesake, the late Sir Edward MacColl, who died in Edinburgh in 1951, at the age of sixty-nine. There was nothing fanciful nor unpractical about Sir Edward, though he shared with Hugh a balanced interest in the occult, and in anything which could not be explained merely in terms of physics. Nothing unpractical about him, I repeat. Nothing unscientific, I might add. This eminent engineer, this brilliant and prolific inventor, this holder of so many patents, especially where high-tension transmission lines and electrical equipment were concerned, was deputy-chairman and chief executive officer of the North of Scotland Hydro-Electric Board. His was the brain behind the mighty hydro-electric projects now taking shape, if not actually nearing completion, throughout the Scottish Highlands.

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A light similar in type is seen rising from Balliveolan House, at the head of Loch Creran. It appears to rise from the roof of the house, to travel in the air down Loch Creran for about a mile before dropping to its extinction in the brine. Among the many local residents who have seen it repeatedly is old John MacPhee, who, for several years, was gardener at Invercreran House, situated but a couple of miles north of Balliveolan. John has furnished many an enquirer with a description of this phenomenon. When Sir Edward MacColl met him on the Loch Creran road in the autumn of 1950, he engaged him in the pleasantries of conversation for several minutes, and was able in the end to get from him some details about it. John MacPhee pointed out to Edward, with great precision, the route which the light follows, and the spot at which it finally plunges into the loch.

ORNITHOLOGICAL REPORT FOR NORFOLK.

ORNITHOLOGICAL REPORT FOR NORFOLK (1907).

By J. H. GURNEY, F.Z.S.

but what attracted most attention were the luminous Barn-Owls, which, received at first with incredulity, were soon proved to be an attested reality, and they are flying about in the county still. That luminous Barn-Owls have been seen before in the same part of Norfolk is certain, and therefore there need not have been so much scepticism about them. We have it on the best authority—namely, from the man himself—that some years ago Frederick Rolfe, a gamekeeper now retired, saw what could have been nothing else when stopping Fox-earths at West Bilney. A few nights afterwards he saw the same shining bird again, subsequently shot it, and found that it was a Barn-Owl. He has a perfect recollection of all the circumstances, and describes the Owl as emitting a very bright light when near him, and that it even continued to give out a slight glow for some hours after it was dead. Other stories are also told of moving lights at night, now believed to have been birds, and there can be little

page 1

doubt that they were Barn-Owls, though that was not suspected at the time. As long ago as 1866 Mr. J. A. Harvie-Brown met with an instance of it in the Barn-Owl in Cambridgeshire, which was never recorded, and other cases might be cited which for various reasons did not find their way into print.

With regard to what causes the luminosity, the general idea in Norfolk is to ascribe it to the luminous touchwood which is occasionally to be seen in trees, more particularly in the ash. At a meeting of the Norwich Naturalists' Society, when the luminosity of Owls was made the subject of discussion, Mr. S. H. Long stated that this luminous touchwood was due to the presence of certain mycelium forming Fungi, which is also what Mr. M. C. Cooke says. In his 'Introduction to the Study of Fungi,' p. 89, Mr. M. C. Cooke says:—"Several Agarics have this property, of which the largest number for any locality have been met with in Australia. All of them are species found growing upon dead wood, and all have white spores. Nearly the same story is related of all of them—to the effect that they emit a light sufficiently powerful to enable the time on a watch to be seen by it." In this way bacteria may have been imparted to the feathers of the Owls by contact, supposing that they inhabited a luminous hollow in some tree.

page 2

Another theory has been put forward by Mr. W. P. Pycraft, viz. that this luminosity may possibly be really due to some species of feather fungus new to science, for, he adds, it is known that feather fungi do exist, and he cites the case of a Goose thus affected. It would be a great pity to shoot these Owls, I think, but if their lair could be discovered we should at any rate see if it was a luminous hole, which would advance us one step in the inquiry.

ZOOLOGIST, ORNITHOLOGICAL REPORT FOR NORFOLK

FEBRUARY. 1908

17th. — *Luminous Barn-Owls*. — Under this date Mr. L. C. Farman writes from Haddiscoe about the shining Owl which was seen there last December (Zool. 1908, p. 135):—"I have again seen the luminous Owl; this time it was on a marsh near where I first saw it [on Dec. 25th, 1907]. I endeavoured to get to it, but the ditch was wide, and whilst going round to the gate it moved off across the marshes." The identical bird had been seen shining in the same locality by another observer on Feb. 12th, the week before Mr. Farman encountered it. In a second letter, describing its appearance more fully, Mr. Farman says:—"The light was exceedingly bright, resembling an electric light, but of course more dim as distance widened, but even at a great distance at times it showed very bright." Sufficient evidence has been brought forward to prove that luminosity in nocturnal birds is after all not so very rare a phenomenon, though seldom approaching the exceptional brilliancy of these Norfolk Owls, but often enough to be the origin of a good many will-o'-the-wisp stories. As has been pointed out by Sir Digby Pigott, who was the first to bring these circumstances before naturalists, similar birds have been seen before. It will be remembered that it was the pair at Twyford, some thirty miles from Haddiscoe, which aroused the chief interest in 1907. They seem to have covered a great deal of ground in their nocturnal wanderings, for one of them was twice seen in March, 1908, at Dereham by Mr. H. Wormald, glowing with exceptional brilliancy. At Twyford a luminous Owl was seen as late as May, 1908. On May 3rd Mr. R. Purdy and Mr. Hegg watched its shining light as it hunted the meadows about 11 p.m. for field-mice; but it was never seen again though searched for, and Mr. Purdy is of opinion that it moulted its feathers, and with

Page 5

them its luminosity disappeared, and the same was doubtless the case with the one at Haddiscoe, of which no more has been heard. Soon after this I was informed by Lord Lindley that he had an ash-stump in his grounds displaying a superficies of about eight inches of luminosity. That there is some connection between luminous trees and luminous Owls is the general opinion here, and is highly probable. The fact that it was the Owl's breast which emitted the chief glow would be thus accounted for, as that part would come most in contact with the decaying wood of a hollow tree.

Page 6

[DAVE CLARKE]

ZOOLOGIST, ORNITHOLOGICAL REPORT FOR NORFOLK (1907)

DECEMBER.

1st.—*The Luminous Owl.*—The luminous Barn-Owl, which, except for one appearance to Mr. Spencer in October, had not been seen since February, was again observed by Mr. R. J. Purdy, his son, and other persons, shining brightly in the same locality as before.

22nd.—Again the luminous Owl showed itself to Mr. Purdy, and between this date and the 29th it was seen by several people, and by many others subsequently. On the 29th its luminosity appears to have been at its maximum, the branches of trees being even lighted up as it flew amongst them. It was presently joined by a companion, also luminous, but not so bright as its mate, and I am assured by Mr. Purdy that on different occasions one or other of them was seen in six contiguous parishes. The nightly rounds of a Barn-Owl, which are often much the same in line of flight, would not be expected to extend further than that under any circumstances. The light is described by those who saw it best as pale yellow with a reddish tinge; at its brightest it was about as brilliant as the light of a bicycle lamp some three or four hundred yards away, and that was what Mr. Purdy at first mistook it for. Anyhow, the light does not seem to have had the effect of giving warning to Rats and Mice, for Mr. Hamond's bailiff saw it drop on one, and heard the little animal shriek. On one occasion the shining bird was quietly seated on a gate, and another time on the ground, having probably just dropped in pursuit of a Mouse. Those who saw it best agree that it was much brighter when coming towards the observer, and especially when rising in the air, but so much did the light pale as it flew away in the contrary direction that it is certain that little, if any, of the glow proceeded

from the back of the bird. I tried my best, in Mr. Hamond's company, to see this ornithological phenomenon, but with no success; though we were rewarded by a gentleman resident in the parish showing us a luminous tree. It was the stump of an ash which, when he found it, had a phosphorescent superficies of several feet on the decayed side, but the glow was not very bright, and there certainly was no hole which could have held an Owl.

25th. — Another luminous Barn-Owl seen in Haddiscoe marshes by Mr. L. C. Farman, an observer not likely to be mistaken, flitting across the marshes near Haddiscoe Dam at about six paces from the ground. It showed very bright at times, and then frequently vanished, no doubt as its breast and head turned away from the observer; but soon it was seen to appear again in the distance, sometimes showing up exceedingly bright. On two subsequent nights Mr. Farman had opportunities of watching it, and one or two other persons also saw it. As Haddiscoe is thirty miles from where the other luminous pair were seen, it could not have been one of them, though the same causes, whatever they were, may have operated to produce it.

page 14

page 15

Une chasse à la palombe mouvementée au Col d'Aspin

L'aventure qui va être contée est déjà ancienne, puisque dans deux mois, il y aura deux ans qu'elle aura été vécue ; mais les deux héros de l'affaire l'ayant tenue secrète de peur d'une moquerie, elle n'est connue que de quelques familiers, et son caractère

exceptionnel lui conserve toute sa valeur. Il a fait l'article de « La Nouvelle République » du 27 juillet dernier pour que l'un des protagonistes de l'histoire sorte de son mutisme, et en nous confiant son récit, nous autorise à le publier. Jouissant à Tarbes d'une grande notoriété, il nous a demandé de ne pas faire figurer son nom ; nous respecterons son anonymat, comme nous nous engageons à le faire pour tous ceux qui voudront bien nous apporter d'autres témoignages.

Voici donc ce récit inédit :

C'était fin septembre ou octobre 1965 et nous avions décidé, avec un de mes amis, de faire une sortie pour chasser la palombe. Les beaux automnes bigourdans invitant aux lointaines randonnées, autant pour le plaisir de la chasse que pour celui du voyage, nous avons choisi comme lieu de nos exploits, le versant est du col d'Aspin qui domine la magnifique vallée d'Arreau.

Impatients des joies en perspective, nous étions partis ce jour-là de très bonne heure de Tarbes, et la nuit régnait encore en atteignant le col d'Aspin. En attendant le petit jour, nous décidons une halte au sommet du col, qui servirait tout aussi bien à refroidir le moteur échauffé de son effort. Dans le profond silence de la nuit, dans l'atmosphère pure et légère de ces altitudes, nous goûtions les senteurs enivrantes de ces solitudes que nos compatriotes connaissent si bien. Assis côte à côte sur la banquette avant de la voiture, nous nous taisions, admirant et le site et l'instant, nos regards errant dans le ciel où brillaient, très pures, les étoiles.

Subitement, sans que rien ne l'annonçât, sans que rien ne le laissât prévoir, j'aperçus à ma gauche, au-dessus de l'arête du Mauné, une lumière bien étrange, resplendissante dans le ciel un peu noir, toute blanche, d'un éclat semblable à celui du néon, de forme ronde, d'un diamètre apparent sensible, à une altitude au-dessus de la crête que je n'ai pu apprécier : 100 ou 200 mètres peut-être. N'en croyant pas mes yeux, je restai quelques secondes saisi d'étonnement, et j'attirai vite l'attention de mon compagnon. La chose était bien là, bien présente à notre vue, mais comme irréelle, immobile, sans bruit, sans fumée, insolite dans ce décor, comme suspendue par des fils invisibles, ne ressemblant à rien de ce que nous connaissions, nous laissant béats de surprise devant ce luminaire inattendu.

Pendant quelques secondes, il ne se passa rien, puis, à notre grande stupeur, de cette lumière troublante dans sa fixité, sortit une lumière blanche filiforme, en zigzag aux angles vifs qui, lentement, se mit à descendre, en chute verticale, comme une échelle de corde que l'on déroulerait du haut d'une corniche. Notre étonnement était indescriptible ; poursuivant sa descente lentement, sans à-coups, le zigzag de lumière atteignit bientôt la crête, qui nous cacha, avec la suite de la descente, le point d'impact de cette chose. Nous étions sidérés !

Paralysés par l'étrangeté de ce spectacle, les yeux rivés sur cette chose extraordinaire, nous avions perdu la notion du temps, quand, soudainement, à gauche de l'objet, à la même hauteur, une lumière exactement semblable à la première fit son apparition ; tout aussi imprévue, tout aussi discrète dans sa venue, comme engendrée sur place et voilà que sous nos yeux incrédules, nous vîmes se répéter le même processus que la première fois. Du disque lumineux, le zigzag de lumière descend lentement et con-

tinue sa course derrière la crête du Mouné. Maudit écran !



COL D'ASPIN . SEPTEMBRE 1965 . 5 HEURES DU MATIN

Quel étonnant spectacle présentaient alors ces deux « ressorts lumineux se détachant dans le ciel et supportant tout en haut ces disques de lumière : lampadaires de rêve dans un décor prestigieux. Sondages, prospection, repérage, marquage, atterrissage ? Ces « tentacules » d'un nouveau genre devaient toucher le sol quelque part, peut-être dans les environs des cabanes de Laca ou de la Souaillère, qui nous étaient cachées par la crête du Mouné (1.755 m) qui culmine au nord du col d'Aspin (1.497 m).

Comme hypnotisés par ce spectacle lumineux, nous le vîmes bientôt s'effacer, disparaître, se diluer, se dissoudre sur place comme fumées, le zigzag en premier, puis les disques, et nous n'avions plus devant les yeux que le ciel étoilé qui commençait à blanchir, à croire que tous les deux nous avions fait un rêve. Nous pensions tristement à la caméra que mon ami avait apportée, mais qui, manque de chance, n'était pas encore chargée !

Mal remis de nos émotions, nous décidons de poursuivre notre route pour atteindre le bois de la Pelade, but de notre chasse. Laisant la voiture en bordure de route, nous remontions la pente, un peu essoufflé quant à moi, mais je ressentais comme une oppression morale qui n'était pas celle de l'effort. Je me sentais inquiet, comme observé par des yeux invisibles, l'impression d'être surveillé, une sensation d'insécurité. C'est dans ces conditions un peu déprimantes que se poursuivait notre marche en avant. Il y avait dans l'air comme un frémissement, un bourdonnement, et je percevais nettement un bruit que je n'arrivais pas à situer, à déterminer, ressemblant à la vibration d'un moteur très puissant. Nous étions seuls cependant, et jetant autour de moi, à droite, à gauche, des regards inquisiteurs, la solitude répondait seule à ma quête, quand soudain, devant nous, frôlant les crêtes proches, nous voyons défiler, se dirigeant vers l'est, une série de ces objets en forme d'assiette creuse qu'il est convenu d'appeler « soucoupes volantes ». Nous en avons compté six qui, en un rien de temps, en file indienne, traversèrent le champ de notre vision. Peut-être derrière le sommet y en avait-il d'autres ? Elles étaient sûrement à l'origine du bruit et de mon malaise, car après leur départ toutes ces manifestations cessèrent.

Avant cette aventure, je ne croyais pas aux « soucoupes volantes » ; je suis maintenant convaincu de

leur existence et depuis lors, bien souvent, la nuit, j'observe le ciel longuement.

Je voudrais bien savoir ce qui se passa derrière le Mouné, et peut-être un jour irais-je à la Souaillère interroger les bergers, pour savoir si l'un d'eux, mieux placé que nous au col d'Aspin, un jour d'automne 1965, n'a pas été le témoin de faits surprenants dont je n'ai eu qu'une vision incomplète.

F. LAGARDE.

(Tiré du récit qui nous a été fait verbalement par un des témoins directs). [JEAN SIDER]

bol 0054

THE BIZARRE STORY OF A LIGHTNING STRIKE

In 1971, Edwin A Robinson, an American truck-driver, had a motor accident which left him blind and partially deaf.

Last summer, he was under a poplar tree, near his home at Falmouth, Maine, looking for his favourite hen, Took-Took. A storm was threatening and he didn't want to lose his bird.

The poplar was struck by lightning. Robinson was stunned. When he came to himself again, some twenty minutes later, he could see very well. A subsequent eyesight test established that he had perfect vision, which is pretty good for a man of 62.

What is more, his hearing was restored by the same stroke of lightning.

But the bonus is that Robinson, who had been bald since the age of 35 - nothing to do with his accident - now has a thick head of hair.

'Science et Vie' no 761, Fev. 1981, p.63

[T. PINVIDIC ; trans H.E.]

MARFA LIGHTS



For generations the mysterious Marfa Lights have defied explanation of their true nature. They keep blinking right along. A favorite pastime in the Big Bend is parking near the entrance to the abandoned airport on Mitchell Flat, nine miles east of Marfa on Highway 90, to watch the Marfa Lights flicker and move against the Chinati Mountains about sixty miles to the southwest. They look like faraway flashlights, they turn on and go out, sometimes one or maybe five or six. Appearing almost every night at dusk, they move vertically and horizontally at what must be tremendous speeds. They come in white, blue, and sometimes red. When Fritz Kahl of Marfa chased them in an airplane, they receded before him, just like the end of a rainbow, even crossing into Mexico.

A rancher-lady in the Big Bend said, "I've seen the Ghost Lights all of my life and can't remember their causing any harm other than fright. They like to follow you out in the pasture at night, seem to be drawn to people and stock, and animals don't seem to fear them at all."

The earliest reported sighting was in 1883 by settler Robert Ellison and his wife on their second night in the Big Bend. According to their daughter, "My daddy said they unloaded their cattle at what is now Alpine and they started driving them toward Marfa. When they came through Paisano Pass and got onto the flats, where you can see for a long distance, they saw the light. He thought it was an Apache campfire, and they weren't too friendly in those times. He finally began to realize it wasn't a homeplace or a campfire. Others in the country before him told him they'd always seen it."

Because they are unexplained, the Marfa Lights have probably spawned more tall tales than anything else has. A supposed Indian myth says they are fallen stars in which the Great Spirit stores the lightning. Or, as the fire in a star goes out, the Great Spirit allows it to choose its resting place, and the stars like the Chinati Mountains. Or, the Marfa Lights are Apache warriors who died fighting the white men, and their ghosts have been allowed to come back to the land they love.

It is said that Indians once were camped on the flat, en route down the Comanche Trail to plunder in Mexico. Fort Davis soldiers attacked and annihilated most of them. Seeking revenge, survivors stole lanterns from settlers,

lit them, and moved around at night, hoping to lure the soldiers into a trap. Their ghosts are still waving the lanterns, thirsting for revenge. Some, however, say the Marfa Lights are the ghost of an American soldier. A cavalry patrol from Fort Davis was camped on Mitchell flat, and one night the sentry went to sleep. The Indians attacked, massacred the soldiers, and in remorse the sentry's ghost wanders about for eternity as a mystery light.

As every treasure hunter knows, buried treasure is often guarded by a mysterious light. Gold is supposed to be hidden on Mitchell Flat in a sacred Indian burying ground. One night several drunk Indians desecrated it by going in and trying to dig up the gold, and they were never seen again. Now their ghosts--the Marfa Lights--are trying to find their way out of that cemetery. Pancho Villa is said to have buried a rich horde in the Chinati Mountains, and the lights are guarding the bandit-liberator's treasure.

A story says that in the days of Spanish occupation, Indian slaves mined gold near San Carlos, Mexico. The Spaniards forced some of the Indians to carry the gold to the Marfa area to bury it, then killed the Indians and buried them with the gold. Those Indian spirits rise and dance as lights above the treasure and say, "If you can find the exact spot of the light, dig and you will find the gold."

High on a mountain cliff in the Chinatis there is supposed to be a red hand-print, which can be seen but which is impossible to reach. The hand is said to point to a grove of cottonwood trees planted in the shape of a horseshoe, though this pattern is obliterated by later growth. Indians hid their gold in the center of the horseshoe, and that treasure is said to be guarded by the Marfa Lights, the spirits of those Indians.

There has always been a host of explanations to attribute natural causes to the Marfa Lights. One of the oldest is that they are sotol plants burned by cowboys to light their camp or mark their trail. Others are:

Mica	Bones in the earth
Gasses from the ground	Static electricity
Uranium	Irregular "pockets in the air,"
Mercury vapor lamps on ranches	that collect light
(strenuously denied by old timers)	Reflections from a comet or meteor
Bat guano in caves	Water flowing between two different
Little volcanoes	ores, which gives off electricity
Reflection of the stars and moon	Gas formed into large balls, which
from the rocks	are somehow ignited
Swamp gas	A negative charge, which, if it ever
Phosphorus in the rocks	meets a positive charge, will blow
Phosphorus buried by phosphorus	up the earth
hunters	Jack rabbits, whose fur glows because
Chemicals left by the Army at the	they have run through luminescent
old airport	brush or have picked up glowworms
Reflections from silver left at	
the abandoned Shafter mines	
Coal deposits	

When Pancho Villa was on the rampage, the Marfa Lights were said to be lanterns guiding his mule trains at night in advance of his invasion of the Southwest. During World War I they were thought to be lights guiding German supply trucks presaging an invasion of the United States. During World War II they were said to be German airplanes in advance of an attack. After the war they were transformed into the ghost of Adolf Hitler, searching for his soldiers who had been prisoners at the Marfa Army Air Base.

During World War II (they say) the Army mounted an expedition to learn the nature of the lights. Two radio equipped jeeps set out, the one in advance chasing a Marfa Light. When the advance men called back that they were on top of the light, their radio squawked and went dead. When the second jeep arrived at the scene, the first jeep had burned up and there was no trace of the men, except for one sock. Totally untrue, of course, as is the story that the Air Base was closed because the lights would maliciously line up like runway lights on a mountainside and lure student pilots into a plane crash.

Such stories abound, because everybody likes to tell and hear goosebumpy yarns. Most people in the Big Bend have heard that somebody else's car has been chased by the Marfa Lights, escaping with only the car-trunk--and sometimes the driver--scorched. But nobody ever heard just who it was who went through the harrowing experience.

As for explaining what the Marfa Lights really are, one story is about as good as another. During World War II (they say) laser fusion weapons experiments were conducted at a Chinati Mountains Research Center. Years ahead of its time, such work was extremely risky. When a field test ran into trouble, the light generated by the laser interfered with the fringes of matter. A gigantic explosion destroyed the Center, leaving a seven-mile-wide scorch area. The accident was kept secret, the government is said to have investigated and then kept super-secret whatever they learned. The mishap knocked holes in space and these holes are the Marfa Lights. People who have disappeared in the area are thought to have fallen through these holes and to be floating somewhere in another dimension.

None of these windy tales have ever discouraged natives or travelers from driving out to Mitchell Flat to watch the harmless Marfa Lights. They have a simple, mysterious beauty all their own.

*With a special interest in folklore research, Dr. Elton Miles is Professor of English at Sul Ross State University. More stories about the Marfa Lights (and other things) may be found in his book, Tales of the Big Bend, published in 1976 at College Station by the Texas A&M University Press.

Prepared by the Museum of the Big Bend, Sul Ross State University, Alpine, Texas.

[DENNIS STACY]

bol 0056

How to Report Ball Lightning

RONALD B. STANDLER, *Department of Atmospheric Science,
State University of New York at Albany*

OVER the past several centuries a large number of people have reported seeing a luminous sphere during thunderstorms. These spheres are most often blue, red, yellow, or white in color and about 10 to 20 centimeters in diameter. They can fall from the clouds, float a meter or so above the ground, and enter buildings. Typically, they are visible from one to ten seconds (Simpson, 1924, and Singer, 1971).

Because these observations of ball lightning, as these spheres are called, are rare, scientists have not been able to obtain sufficient data on them to be able to explain ball lightning. An eminent physicist, Professor Leonard B. Loeb, who has himself observed ball lightning, has stated:

These occasional phenomena occur under such unexpected and rare circumstances that up to the present it has been impossible either to obtain any quantitative data on them or to conjure up sufficiently close analogs from our experience in the laboratory as to permit obtaining useful data on which to base a theory. In the light of this profound ignorance, attempts to account for them, let alone derive a theory, can only lead to untimely, misleading, and futile speculation. (Loeb, 1966).

Because ball lightning is rare and unpredictable, data have not been taken by trained scientific observers who are prepared to witness the phenomenon. (One notable exception has, fortunately, occurred [Dmitriev, 1969].) It is important, therefore, that anyone who is fortunate enough to witness ball lightning should communicate an accurate description of it to scientists who are studying this phenomenon. It is suggested that reports be sent to:

Professor Bernard Vonnegut, ES 323
State University of New York at Albany
1400 Washington Avenue
Albany, New York 12222

Professor Vonnegut may be reached by telephone at 518-457-4607. Reports may also be submitted for publication in scientific magazines and journals, where they will be permanently available to all interested scientists.

Because ball lightning is a brief occurrence, it is imperative that the witness not leave the scene in order to obtain a camera or other instrument. If a camera is ready, particularly a movie camera, and in hand, then a photograph of the ball would be useful. But a valuable observation can be made without using any instruments at all.

When ball lightning is seen, extend your hand and measure the apparent size of the ball in terms of your hand and fingers at arm's length. For example, the ball might be the size of your thumbnail at an arm's length. After the ball lightning has vanished, measure with a yardstick the distance from your eye to your hand when in a posture similar to that used during the observation. Also, measure with a ruler the size of the various parts of your hand mentioned in your report. From these two measurements, scientists can compute the angular diameter of the ball.

While you are observing the ball, notice objects behind and in front of the ball's path. After the ball has vanished, measure with a yardstick, or if too long by pacing off the distance, the distance from your observation point to these objects. These distances, along with the angular diameter, will allow the scientists to compute the size of the ball.

A computation of the size of the ball from the above information is more reliable than estimates or guesses by any observer. Also some scientists (Humphreys, 1936) have stated that some ball lightning is merely an illusion caused by seeing a bright flash of ordinary lightning. Noting the spatial location of the ball will help demonstrate the physical reality of the ball.

[V.-J. BALLESTER OLMOS]

The report should include a description of the trajectory of the ball and its apparent speed, color, brightness, structure and shape, sound, heat, odor, and any other notable properties. One should be aware that the absence of some characteristic property is just as significant as an observation of intense amounts of this same property. For example, the fact that the ball is silent is just as important (and should be included in the report) as would be the fact that the ball made a deafening racket.

There are several other details that might also be helpful to scientists. Did you have a radio or television on during the occurrence of ball lightning? Was any static noticed? Ask your neighbors if they noticed any static at the time you saw the ball.

While you are measuring the distances from your observation point to objects around the ball's path, be alert for physical evidence of the ball. Perhaps you can find bits of melted metal from a wire fence or electric line, burn marks on grass or trees, splinters from any violent contact of the ball with an object, etc. Photographs of damage caused by the ball would be very helpful. Include in your report the items for which you were looking and what, if any, you found. Inquire from neighbors and in your home if any electrical fuses were blown apparently as a result of the ball lightning.

It would be appreciated if you could include a drawing or photograph of the region traversed by the ball and a sketch of the ball itself with the location of items mentioned in your report indicated in your drawing.

One item, which has been apparently assigned too much significance in reports of ball lightning, is the time of the sighting. It is quite sufficient to report the time to the nearest five minutes. It would be of some value to know the duration of the sighting and the time required for the ball to traverse a known distance. However, if these time measurements would interfere with your observations of more important items mentioned above, delete the time measurements.

One should be particularly careful to describe the appearance and disappearance of the ball, as these two critical periods are of the highest importance to scientists seeking an understanding of ball lightning. A description of the ball's behavior near conduct-

ing objects would be of interest to many scientists.

It is also important to relate the sighting of the ball to meteorological conditions. A brief description of the weather at the time of the observation together with the frequency and approximate distance of ordinary, forked lightning flashes would be appreciated. Mention of the direction and speed of the wind in relation to the motion of the ball may be an important clue to the nature of ball lightning.

Check List

1. Angular Size
 - A. Apparent size (in inches or centimeters) at arm's length
 - B. Length of arm (in inches or centimeters)
2. Distance to objects near ball's path
3. Various physical characteristics: (Note also characteristics which were absent but would have been observed if the ball were to have demonstrated such properties)
 - A. Path of ball, trajectory, speed
 - B. Color
 - C. Brightness
 - D. Structure and shape of ball
 - E. Sound
 - F. Heat
 - G. Odor
 - H. Radio or television static
 - I. Duration of sighting
4. Changes of above characteristics during observation of ball lightning
5. Damage from ball (including photographs, if available)
6. Details of appearance and disappearance of ball
7. Weather at time of observation
 - A. Thunderstorm?
 - B. Ordinary Lightning?
 - C. Wind direction and speed?
8. Date and time of sighting

From the number of the above suggestions, it is obvious that some notes must be written down within a few minutes of the sighting if one is to avoid forgetting important details. It is suggested that the final report should be written within a week of the observation, if possible, and communicated to scientists.

MORE BALL LIGHTNING INCIDENTS

Mike Rowe's press appeal continues to bring in fresh examples of interesting ball lightning incidents which have never been previously published. In this issue we publish a few more examples.

GREAT BOWDEN, LEICESTERSHIRE, ABOUT 1882/84

In reply to your letter in the *Galloway Gazette* of 4th February asking for accounts of ball lightning, you might be interested in the following account of one such experience given to me by my mother many years ago, although it was not in Scotland.

The date of the occurrence was in the evening of a day in July, in the period 1882-1884. The place was on a country road between Great Bowden and Market Harborough (SP 7488), Leicestershire. My mother as a child of 7-9 years was travelling with her parents and other children of the family in a horse-drawn cab (commonly called a growler, I believe) from Great Bowden to Market Harborough, after visiting relatives, when there was a terrific thunderstorm. Suddenly there was an uncanny hush and the party saw a fireball (up to one foot in diameter) rolling towards the cab on the road, and, as it passed underneath the cab, there was an explosion and the cab was tipped partly into the ditch at the side of the road, the driver being thrown over the hedge. Fortunately on investigation it was found that he was only shaken by the experience and he managed to get the cab to Market Harborough by leading the horse, which had been blinded by the explosion, although it recovered after a few days.

Examination of the cab, which fortunately had a double bottom, revealed that the outer layer had been completely splintered to pieces, and the party could have been killed with only a single bottom in the cab.

I hope that this account, which I am sure is an accurate account of what happened, will prove useful to you.

10 Laigh Isle, Isle of Whithorn, Newton Stewart, Scotland. J. A. MARRIOTT

BALL LIGHTNING AT BLACKROCK, COUNTY CORK, 1915/16

It seems funny to be writing about something that happened in 1915/16 at class one day. It must have been June as the window was opened wide. The fireplace was right opposite the window and the class was sitting all to one side of the room. Slowly in through the window came this large red ball (about twice or three times the size of a football), and it passed in front of us and went up the chimney. Simultaneously, there was a huge crack of thunder, and as a matter of fact the building was split and a castle nearby was also struck. The building is the Ursuline Convent boarding school, Blackrock, County Cork.

This is the best my memory can do, and I hope it will be of use to you.

St. Gerards, Florence Road, Bray,
Co. Wicklow, Ireland.

(Mrs.) M. E. COUGHLAN

UNUSUAL BALLS OF LIGHTNING, ABOUT 1927, IN KENT

With reference to your inquiries in today's issue of *Extra*, I had a tremendous experience of fireballs all around me some years ago.

The year was 1927 (as far as I can recollect). I was sleeping out in my bivouac in

the small meadow (then an orchard) which lays between Port Farm House and the main road, Upstreet.

I was awakened by a tearing gale which inflated the tent and threatened to blow it down. Looking out, I became aware of round globules of fire (about the size of coconuts) bouncing over the tops of the apple trees. Then it pelted with rain. Hurriedly, I stowed everything into a wrapped ground sheet and waited for the rain to ease off a bit, before rushing over to the shelter of the back-door boot shed. I well remember that just as I was about to jump over the back-lawn gate a globule danced over the top of it - all of which was exceedingly un-nerving. A bit of quick thinking and a boot knife led to entry through a sash window and thus into the house.

18 Walnut Tree Lane, Westbere,
Canterbury, Kent.

JOHN LANGFORD-WEEKLEY

(Second letter). Glad to have been of interest.

Scene: Around late summer, about mid-night. Whole area lit as by day-light. Balls of lightning (?) glowing as bright as any magnesium flares (i.e. white) dancing over most of the trees in orchard. A tearing wind blowing and bending upper boughs and my bivouac inflated like a balloon. After dancing for say 3 to 4 seconds the balls just disappeared in a flash, their place being taken up by others.

Then a sudden downpour, but the display continued through this and was to carry on after raining ceased. There was no thunder or signs of any normal lightning that night.

JOHN LANGFORD-WEEKLEY

BOUNCING BALL OF FIRE, AT VALE, GUERNSEY, 1933

With reference to your recent letter in our local press, I would like to inform you of an incident which occurred in the Vale parish of Guernsey in 1933. It was late at night and I was cycling along Rue des Marais (lane) which is a marshy area; a mist was hanging low over the fields. Looking back before turning into my gateway. I saw to my fright, what could only be described as a ball of fire, bouncing along at a fast pace along the top of the hedge. I didn't wait but got quickly indoors, telling my father of this to which he replied, "That's the Willow-the-Wisp, Linda." He actually told me this in Patois (Guernsey French), Feu (fire) Boullangey which means Fireball.

St. Peter Port, Guernsey, Channel Islands.

LINDA REGAN

[J. Bord]
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601 0057

Ball-lightning model

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Zh. Tekh. Fiz. 47, 814-822 (April 1977)

A model is discussed for ball lightning. According to this model, the radiation is due to the decomposition of ozone which reacts with nitrogen oxides. A kinetic study is made of the processes which occur in air containing impurities of ozone and nitrogen oxides. The parameters for the time evolution of this system are found. The relationship between this model and the observed properties of ball lightning is analyzed.

PACS numbers: 92.60.Pw, 92.60.Hp

1. In this paper we study the decomposition rate of excited air, which can be produced in a limited volume as the result of electrical phenomena in the atmosphere. Since this air is at a relatively low temperature, the ozone and nitrogen oxide levels are above their equilibrium values. Chemical reactions of these species result in their chemical decomposition and a warming of the air.

We are led to this problem in an effort to determine the nature of ball lightning. Ball lightning is an interesting natural phenomenon which has attracted attention since ancient times. According to observations and research, (Refs. 1, 2), a glowing ball in air can be produced in several ways. One way, demonstrated by Kapitsa,³ is to produce a glowing plasma by means of an external microwave source. If the gas flow is stabilized, the glowing plasma assumes the shape of a ball. Another type of glowing ball is formed when a lightning bolt strikes a solid medium⁷; in this case the ball consists of the vapor of this solid medium at a temperature of several thousand degrees Celsius. This ball is considerably heavier than the air, so that it touches the ground.

Of primary interest is the third and most common type of ball lightning, which is maintained by internal energy and which is not very different from air in terms of its density. Under these conditions the temperature of the ball lightning cannot be very high, and it may float in the air. Typical properties of ball lightning, which we adopt for use below, are^{1,2} a diameter ~ 20 cm and a lifetime ~ 10 sec. The power associated with ball lightning can be estimated to be 10-100 W, on the basis of a comparison of its effect with that of gas-discharge light sources.

In Ref. 4 we analyze the elementary processes and demonstrate that none of the hypotheses regarding the energy source for ball lightning except the chemical hypothesis is capable of explaining these properties. The essential argument here is that processes involving a conversion of the energy of any excited particles in air into thermal energy occur too rapidly, so that no mechanism for energy storage in ball lightning other than the chemical mechanism can explain the observed lifetime of ball lightning.

The predominant species resulting from electrical excitation of air are ozone and nitrogen oxides. Only these species were found to be at elevated levels in Dmitriev's unique experiments,^{1,5,8} carried out in 1967, involving a chemical analysis of the traces of ball lightning. Furthermore, the concentrations of these species resulting from

electrical phenomena in the atmosphere are capable of explaining the observed energy release in ball lightning. In order to explain the glow of ball lightning, we must take account of other species which are involved in the partial conversion of the chemical energy stored in the ozone into visible light. The presence of these species accelerates the decomposition of the ozone. Accordingly, by finding the decomposition time of ozone in air containing nitrogen oxides and by comparing this time with the lifetime of ball lightning we can test the chemical hypothesis for ball lightning, according to which the energy is released during the decomposition of ozone.

2. The decomposition of ozone in excited air is governed by the elementary chemical reactions involving ozone and the other species in excited air; on the other hand, the elementary chemical reactions result in a warming of the air, which further accelerates the processes involved. Our purpose in the present paper is to take both factors into account in a study of the decomposition of ozone. Transport phenomena play an important role in establishing the shape of ball lightning and its dimensions, but they do not fundamentally affect its lifetime, i.e., the scale time for the conversion of the energy stored in the ball lightning into thermal energy. Accordingly we ignore transport processes in this study of the decomposition of excited air.

The problem thus reduces to finding the decomposition time of the ozone formed by electrical phenomena in air. Before actually treating this problem we will determine the ranges of the properties in which we are interested, primarily the decomposition of ozone and the nitrogen oxides. These species form during electrical processes in air, and if the air is hot enough the ozone decomposes rapidly, being converted into molecular oxygen. We are interested in the time scale associated with the lifetime of ball lightning, which is measured in seconds. We must accordingly restrict the temperature range to about 400°K, since the ozone in hotter air decomposes in a time much shorter than the times in which we are interested.

Let us estimate the order of magnitude of the concentration of ozone and nitrogen oxides in excited air. We examine the nature of the production of ozone in electric discharges in air. A thermodynamic calculation^{7,8} shows that if the ozone is produced as hot air from the channel of straight lightning mixes with the surrounding cold air the maximum ozone concentration in the resulting

TABLE I. Rate Constants of the Chemical Reactions

Reaction	Rate constant	Reference
$O + O_3 + X_2 \rightarrow O_2 + X_2, X \equiv O, N$ (1)	$6 \cdot 10^{-34} \text{ cm}^6/\text{sec}, T = 300^\circ\text{K}$	[10-11]
$O_3 + X_2 \rightarrow O_2 + O_2 + X_2$ (2)	$5 \cdot 10^{-21} \exp\left(-\frac{12700}{T}\right) \text{ cm}^3/\text{sec}$	
$O + O_3 \rightarrow 2O_2$ (3)	$1.7 \cdot 10^{-11} \exp\left(-\frac{2230}{T}\right) \text{ cm}^3/\text{sec}$	[9, 10, 18-19]
$O + NO_2 \rightarrow O_2 + NO$ (4)	$9 \cdot 10^{-13} \text{ cm}^3/\text{sec}$	[9, 10, 18-20]
$O_2 + NO_2 \rightarrow O_3 + NO_2$ (5)	$7 \cdot 10^{-13} \exp\left(-\frac{3520}{T}\right) \text{ cm}^3/\text{sec}$	[9, 10, 18-20]
$2NO_2 \rightarrow 2NO_2 + O_2$ (6)	$4.3 \cdot 10^{-12} \exp\left(-\frac{3870}{T}\right) \text{ cm}^3/\text{sec}$	[10]
$NO_2 + NO_2 \rightarrow NO_2 + NO + O_2$ (7)	$3 \cdot 10^{-13} \exp\left(-\frac{1960}{T}\right) \text{ cm}^3/\text{sec}$	[1]
$NO_2 + NO \rightarrow 2NO_2$ (8)	$8 \cdot 10^{-13} \text{ cm}^3/\text{sec}$	[9, 10, 21]
$NO + O_2 \rightarrow NO_2(^3A_2) + O_2$ (9)	$7.8 \cdot 10^{-13} \exp\left(-\frac{1220}{T}\right) \text{ cm}^3/\text{sec}$	[9, 10, 19, 22-23]
$NO + O_2 \rightarrow NO_2(^1B_2) + O_2$ (10)	$1.3 \cdot 10^{-12} \exp\left(-\frac{2120}{T}\right) \text{ cm}^3/\text{sec}$	[9, 10, 24]
$NO_2(^1B_2) \rightarrow NO_2(^3A_2) + h\nu$ (11)	—	
$NO_2 + NO_2 + X_2 \rightarrow N_2O_4 + X_2$ (12)	$10^{-21} \text{ cm}^3/\text{sec}, T = 300^\circ\text{K}$	[10]
$N_2O_4 + X_2 \rightarrow NO_2 + NO_2 + X_2$ (13)	$9 \cdot 10^{-21} \text{ cm}^3/\text{sec}, T = 300^\circ\text{K}$	[10]

Note: T , the gas temperature, is expressed in degrees Kelvin.

mixture is about 0.5% if the temperature of the cold air rises 100° as a result of the mixing.

The concentration of nitrogen oxides is roughly an order of magnitude lower than that of the ozone. A much higher ozone concentration can be achieved in air if the air is excited with a weak electric discharge. In this case, oxygen molecules are dissociated by electron impact ($e + O_2 \rightarrow e + 2O$), and the resulting atomic oxygen is converted into ozone by becoming attached to an oxygen molecule. We assume that energy is released only in the last process ($O + O_2 \rightarrow O_3 + 1.05 \text{ eV}$); then if no heat is lost a 100° rise in the temperature of the air corresponds to the formation of ozone in a concentration of 3%. On this basis, we assume below that the temperature of the excited air changes up to 400°K, that the ozone concentration in this air is of the order of 1%, and that the concentration of nitrogen oxides is an order of magnitude lower.

3. What are the elementary processes which occur in excited air? The rate constants for the chemical reactions which may be pertinent for the property ranges of interest here are listed in Table I. We see that the decomposition of ozone involves transitions between different types of nitrogen oxides; the total number of nitrogen oxide molecules is conserved. The chemical transitions themselves among the various nitrogen oxides are cyclic in nature. Reaction (11), which involves the emission of an electronically excited NO_2 molecule, does not occur at atmospheric pressures, since the scale time for the deexcitation of this molecule is much longer than the scale time for quenching of the excited state in collisions with surrounding molecules.

On the basis of the rate constants for the elementary chemical reactions we can write a system of balance equations for the densities of ozone and the nitrogen oxides. By solving this system together with the equation for the air temperature, which incorporates the heat released

in these reactions, we can follow the decomposition of the ozone. The problem is simplified substantially, since the time required for the establishment of an equilibrium among the various chemical species at the given temperature under the conditions assumed here is much shorter than the scale time for a temperature change.

Table II shows typical values of the time required for an equilibrium to be reached among the concentrations of the various species in excited air. On the basis of this table we assume that the various species in excited air, in fact, reach equilibrium. Then the concentrations of atomic oxygen and ozone are related by

$$\frac{[O]}{[O_3]} = f(T), \quad (14)$$

where $[O]$ and $[O_3]$ are the corresponding concentrations, and $f(T)$ is the equilibrium constant for reactions (1) and (2). Table III shows the values of this equilibrium constant²³ for atmospheric pressure and for the temperature range 250–450°K, in which we are interested. We neglect

TABLE II. Scale Time for the Establishment of Equilibrium between the Densities of the Various Species, τ_{eff}

Reaction	$\frac{1}{\tau_{\text{eff}}}$	$\tau_{\text{eff}}, \text{ sec}$	
		$T = 300^\circ\text{K}$	$T = 400^\circ\text{K}$
$O_3 + O \rightleftharpoons O_2$	$k_1 [O_3] [X_2]$	10^{-6}	$2 \cdot 10^{-4}$
$2NO + O_2 \rightleftharpoons 2NO_2$	$(k_9 + k_{10}) [O_2]$	$3 \cdot 10^{-3}$	10^{-4}
$2NO_2 + O_2 \rightleftharpoons 2NO_3$	$k_5 [O_2]$	0.07	$5 \cdot 10^{-3}$
$N_2O_4 \rightleftharpoons NO_2 + NO_2$	$k_{12} [X_2] [N]$	10^{-6}	$2 \cdot 10^{-6}$

²³The notation for the rate constants is that of Table I. The concrete values of τ_{eff} are calculated for an air pressure of 1 atm, an ozone concentration of 1%, and a concentration of 0.1% for the nitrogen oxides in the nitrogen oxides. The values listed for τ_{eff} correspond to this range of parameters and to the specified mixture temperatures.

²⁴Here $[N]$ is the concentration of nitrogen nuclei in the nitrogen oxides.

TABLE III. Equilibrium Constants for Thermodynamic Equilibrium

	T, °K				
	250	300	350	400	450
$\frac{[O][O_2]}{[N_2O_5]}$	$2.5 \cdot 10^{-18}$	$1.2 \cdot 10^{-11}$	$5.0 \cdot 10^{-9}$	$4.6 \cdot 10^{-7}$	$1.6 \cdot 10^{-6}$
$\frac{[NO_2][NO_3]}{[N_2O_5]}$, cm ⁻³	$2.0 \cdot 10^7$	$2.5 \cdot 10^{10}$	$4.8 \cdot 10^{13}$	$2.3 \cdot 10^{14}$	$4.4 \cdot 10^{15}$

vibrationally excited states of the ozone molecules and omit from Table I the variation of the rate constants of the ozone reactions as functions of the vibrational temperature,⁴⁰⁻⁴² since this effect is weak. Furthermore, Table III shows the equilibrium constant for the reaction $N_2O_5 \rightleftharpoons NO_2 + NO_3$, for which there is also a thermodynamic equilibrium. This rate constant is found from hand-book data.⁴³

Let us determine the nature of the ozone decomposition under these conditions. The basic decomposition cycle includes reactions (5) and (6), which we supplement with the reactions which establish the thermodynamic equilibrium, $NO_2 + NO_3 \rightleftharpoons N_2O_5$. We ignore reaction (4), which is slow in comparison with (5) in the temperature range in which we are interested. This step is legitimate if

$$\frac{[O]}{[O_2]} \frac{k_4}{k_5} \ll 1, \tag{15a}$$

and the data in Table IV show that this inequality holds. We also ignore reaction (3) in comparison with (5), as we may if

$$\frac{[NO_2]}{[O_2]} \gg \varphi(T) \equiv \frac{2k_1[O]}{k_3[O_2]}. \tag{15b}$$

Table IV shows the values of the function $\varphi(T)$. We see from Table IV that this latter inequality holds.

Noting that the transitions between NO_2 , NO_3 , and N_2O_5 result from reactions (6), (5), and (13), and noting that the thermodynamic equilibrium $NO_2 + NO_3 \rightleftharpoons N_2O_5$ obtains, we can easily find the relations between the concentrations of these species. If we also specify the density of the nitrogen oxides, we can determine the equilibrium densities for the various types of nitrogen oxides¹⁾ corresponding to the given temperature and the given ozone density. These data are shown in Table IV.

Taking account of the above conditions we write the balance equation for the ozone concentration as

$$\frac{d[O_2]}{dt} = -k_1[NO_2][O_2]. \tag{16}$$

Decomposition of the ozone results in a warming of the mixture. Taking this circumstance into account, we find an equation for the mixture temperature. The energy expended per air molecule is²⁾

$$e = \frac{7}{2} T + cD,$$

where $D = 1.5$ eV is the energy released in the decomposition of a single ozone molecule³⁾ $[O_3 - (3/2)O_2]$, and c is the ozone concentration (the ratio of the number of ozone molecules to the number of air molecules in a given volume). The quantity e is conserved as the ozone decomposes; the following equation describes the temperature change:

$$\frac{dT}{dt} = -\frac{2}{7} D \frac{dc}{dt}. \tag{17}$$

The solution of this equation makes it possible to relate the temperature of the air volume under consideration to the ozone concentration at a given time:

$$T - T_0 = \frac{2}{7} D(c_0 - c), \tag{18}$$

where T_0 is the initial gas temperature, and c_0 is the initial ozone concentration. Hence the final temperature of the air at the given point is

$$T_1 = T_0 + \frac{2}{7} Dc_0. \tag{19}$$

In particular, for an initial ozone concentration of

TABLE IV. Equilibrium Densities of the Various Nitrogen Oxides

		T, °K				
		250	300	350	400	450
		$k_1[O_2]k_3[O_2]$				
		$4.2 \cdot 10^{-9}$	$1.9 \cdot 10^{-6}$	$1.5 \cdot 10^{-4}$	$1.0 \cdot 10^{-3}$	$5.1 \cdot 10^{-3}$
		$\varphi(T)$				
		$2.3 \cdot 10^{-11}$	$4.5 \cdot 10^{-8}$	$1.0 \cdot 10^{-6}$	$6.0 \cdot 10^{-5}$	$1.6 \cdot 10^{-4}$
$c_{O_3} = 10\%$	$[NO_2]$, cm ⁻³	$6.6 \cdot 10^{13}$	$6 \cdot 10^{14}$	$2.7 \cdot 10^{18}$	$7.6 \cdot 10^{19}$	$1.5 \cdot 10^{20}$
	$[NO_3]$, cm ⁻³	$4.5 \cdot 10^9$	$5.6 \cdot 10^{11}$	$1.6 \cdot 10^{18}$	$1.6 \cdot 10^{14}$	$6.7 \cdot 10^{15}$
	$[NO_2] + 2[N_2O_5]$	$2.2 \cdot 10^{-9}$	0.023	0.13	0.42	0.92
$c_{O_3} = 30\%$	$[NO_2]$, cm ⁻³	$1.5 \cdot 10^{14}$	$1.2 \cdot 10^{18}$	$5.6 \cdot 10^{18}$	$1.7 \cdot 10^{18}$	$3.8 \cdot 10^{18}$
	$[NO_3]$, cm ⁻³	$6.5 \cdot 10^9$	$9.1 \cdot 10^{11}$	$2.4 \cdot 10^{18}$	$2.6 \cdot 10^{14}$	$1.7 \cdot 10^{15}$
	$[NO_2] + 2[N_2O_5]$	$1.6 \cdot 10^{-9}$	0.017	0.091	0.30	0.79

TABLE V. Decomposition Half-Life (seconds) of Ozone in Air

Initial concentrations of ozone and nitrogen oxides	T, °K				
	250	300	350	400	450
$c = 1\%$, $c_N = 0$	$3.3 \cdot 10^{10}$	$2.2 \cdot 10^9$	$2.4 \cdot 10^8$	15	0.3
$c = 1\%$, $c_N = 0.1\%$	$5.6 \cdot 10^9$	$5.9 \cdot 10^8$	48	1.4	0.088
$c = 3\%$, $c_N = 0$	$4.9 \cdot 10^9$	$2.5 \cdot 10^7$	330	2.0	0.039
$c = 3\%$, $c_N = 0.3\%$	$1.7 \cdot 10^9$	$1.8 \cdot 10^8$	14	0.39	0.024

Note: c) Ozone concentration; c_N) concentration of nitrogen nuclei in the nitrogen oxides.

1% the decomposition of the ozone changes the air temperature by $T_1 - T_0 = 50^\circ\text{K}$.

Assuming the pressure to be constant and that (15) holds, we write balance equation (16) as

$$\frac{d\left(\frac{c}{T}\right)}{dt} = -k_3 \frac{c}{T} [\text{NO}_2]. \quad (20)$$

The balance equation for the air temperature can be written in the following manner on the basis of Eqs. (17) and (20):

$$\frac{dT}{dt} = \frac{T(T_1 - T)}{T_1} k_3 [\text{NO}_2]. \quad (21)$$

Solving (21), we find the dependence of the air temperature. This equation should be solved with the initial condition $T = T_0$ at $t = 0$. Table V shows the results of a solution of this equation. Shown here are the times at which half the ozone has decomposed for specified initial conditions (the initial temperature, the ozone concentration, and the concentration of nitrogen oxides).

The time required for the decomposition of ozone in air in the presence of nitrogen oxides has been measured in experiments carried out in the L. V. Kurchatov Institute of Atomic Energy, Moscow. The experiments are carried out at temperatures over the range 336-370°K; the ozone concentration is about 1%, and the concentration of nitrogen oxides is many times smaller. On the average the measured ozone decomposition times turn out to be twice the calculated values. Thus, preliminary measurements confirm qualitatively the present calculations.

4. The method of the present work can be used to treat another problem, that of the formation of ozone in air. Let us determine the maximum ozone concentration which can be achieved when air is excited by a weak electric current. We assume that the electron energy is used in the optimum manner and is expended only in the dissociation of oxygen molecules. The oxygen atom then participates in reactions (1) and (3), being converted into ozone or destroying ozone. These processes are accompanied by the release of energy and an increase in the air temperature. The warming of the air accelerates the decomposition of the air and limits the air concentration. We assume that there is no heat removal and that the air contains no water.

Let us determine the maximum ozone concentration for these conditions. The balance equation for the ozone density can be written as follows, on the basis of reactions (1) and (3):

$$\frac{d[\text{O}_3]}{dt} = k_1 [\text{O}_2][\text{X}_1][\text{O}] - k_2 [\text{O}_3][\text{O}].$$

It follows from this equation that if the ozone concentration exceeds

$$c_{\text{max}} = \frac{k_1 [\text{O}_2]}{k_2}, \quad (22)$$

the addition of atomic oxygen to the air at the given temperature leads to a reduction of the ozone concentration.

Let us determine the fate of an individual oxygen atom. There is a probability of $c_{\text{max}}/(c + c_{\text{max}})$ for its conversion into an ozone molecule (c is the ozone concentration), and there is a probability of $c/(c + c_{\text{max}})$ for its reaction with an ozone molecule, which results in the destruction of the ozone molecule. The change in the number of ozone molecules after the introduction of a single oxygen atom is thus $(c_{\text{max}} - c)/(c_{\text{max}} + c)$. The conversion of one oxygen atom results in the release of an energy

$$\frac{\Delta \epsilon_1 c_{\text{max}} + \Delta \epsilon_2 c}{c_{\text{max}} + c},$$

where $\Delta \epsilon_1 = 1.05 \text{ eV}$ and $\Delta \epsilon_2 = 4.06 \text{ eV}$ are the energies released per event in reactions (1) and (3), respectively. Also, using the value of the specific heat of air, we find the following equation relating the air temperature to the ozone concentration:

$$\frac{dc}{dT} = \frac{(c_{\text{max}} - c)}{\Delta T \left(c_{\text{max}} + \frac{\Delta \epsilon_2}{\Delta \epsilon_1} c \right)}, \quad (23)$$

where $\Delta T = 35^\circ$ is the heating of the air as the result of the formation of ozone in a concentration of 1% through reaction (1). Table VI shows the maximum ozone concentrations achievable under the given conditions, along with the temperature corresponding to the concentration maximum ozone concentration used earlier agree with the data in Table VI.

5. Let us analyze the results. The kinetic decomposition of ozone in excited air is analyzed at moderate temperatures; various elementary chemical reactions which occur in air under these conditions and which are accompanied by heat evolution are taken into account. Although this problem is posed in connection with a study of the nature of ball lightning, its solution can be of interest to other problems involving the atmosphere. With regard to ball lightning, it follows from these results (Table V) that the decomposition of ozone in air at a concentration (Ref. 4) of the order of 1% and at moderate temperatures

TABLE VI. Maximum Achievable Ozone Concentrations

Initial temperature, °K	Maximum ozone concentration, %	Temperature corresponding to maximum concentration, °K
250	2.8	422
275	2.2	431
300	1.8	446
325	1.5	460
350	1.3	475

occurs slowly in comparison with the lifetime of ball lightning. The mixing of excited air containing ozone with other chemical species accelerates the decomposition of the ozone and leads to a glow.

We thus do not find the contradiction which would arise if the ozone which formed naturally in a mixture with nitrogen oxides decomposed rapidly in comparison with the lifetime of ball lightning. By the same token, at the present level of our understanding of the nature of the events occurring the chemical mechanism for ball lightning, based on ozone, remains plausible.⁵⁾ On the other hand, the basic problem of ball lightning — that of explaining its glow — remains a puzzle.

— We wish to draw attention to another feature: We have been talking about an ozone concentration in air of the order of 1%, which corresponds to the optimum method for the production of ozone in an electric discharge (Table VI). At the same time, the maximum achievable ozone concentrations in air and the maximum achievable concentrations of ozone in smog are lower by four or five orders of magnitude. The resolution of this contradiction is that the situation described in the present paper is a rare phenomenon. It arises under extremely favorable conditions and persists for a relatively short time in a bounded volume. The observation of such ozone concentrations under natural conditions is extremely unlikely. Turning back to ball lightning, we note that this phenomenon is even rarer, since according to our arguments it occurs in the mixing of the excited air discussed above with certain chemical species. These species undoubtedly differ from case to case, since the glow of ball lightning is extremely varied. The glow is the main problem of the study of ball lightning, and with this paper the author would like to initiate research in this field.

¹⁾The concentration of nitrogen nuclei in the nitrogen oxides is an order of magnitude lower than the ozone concentration.

²⁾We express the temperature T in energy units and assume that the temperature change occurs at a constant pressure.

³⁾We are dealing with the temperature range in which we have $k(T) = [O]/[O_2] \ll 1$, so that we neglect the energy released upon the recombination of oxygen atoms.

⁴⁾For an ozone concentration of 1%, the chemical energy stored in air is 0.06 J/cm^3 , which is quite adequate for explaining the energy evolution in ball lightning.

⁵⁾The hypothesis of the chemical nature of ball lightning was first advanced by the French scientist Francois Arago in 1859. The following passage appears in this monograph *Thunder and Lightning*,⁴⁴ which was the first monograph on lightning: "These fireballs appear to be a cluster of matter extensively permeated with a stormy substance . . . As lightning passes through the atmosphere, it causes two constituent gases of the atmosphere to combine in certain places, forming nitric acid. We therefore cannot rule out the possibility that the same mechanism sometimes leads to the production of short-lived semi-compounds of all possible substances which can exist in a certain volume of air."

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Translated by Dave Parsons

B. M. Smitnov

[V. J. BALLESTER OLMOS]

bol 0059

PURPLE FURRY/SPIKY BUBBLE

December 3, 1979. Fleetwood, England.

"On the evening in question there was an intermittent thunderstorm with rain in heavy showers. My son Michael had just come in from college and gone into the room and was standing watching the T. V. The time would be a little before six p. m. I said something to the effect that his meal would be ready and he better wash his hands, etc., so he turned the television off although it remained plugged in. We continued talking for a minute or so. The room was lit by a sixty-watt table lamp. At this point a spherical object about six inches in diameter floated down the (sealed) chimney and into the room. It appeared to be rather like a soap bubble but was dull purple in colour covered or rather made up of a furry/spiky emission all over. The coating seemed to be about one inch thick with spikes two inches long here and there but changing all the time. It was quite dim and appeared to be semi-transparent in so much as I could see through to the inside of the opposite side which appeared quite smooth, all the spikes pointing outwards from its surface. It appeared to me to be insubstantial and made no sound. It drifted between the two of us towards the television screen at about thirty inches from the floor, covering the six feet in about four seconds. When about eight inches from the screen it disappeared (imploded?) with a fairly loud crack/pop sound leaving behind a smell as of an electrical discharge. " (Huntington, James; "More Ball-Lightning Reports," Journal of Meteorology, U. K., 11:149, 1986.) (See SF#47 for a long-lived aerial "bubble" seen at sea.)

Courtesy William Corliss

'Science Frontiers' no48

bol 0060

Dear Hilary;

Re; Fireball

I've been receiving your Bollide Data and thought you might be interested in my personal experience many years ago while I was living in my wonderful state of Florida below Miami in a small town called Homestead.

I have never forgotten this experience and never really heard of bolides or fireballs, etc. I just happen to call it a fireball. I never even believed in UFO's until a year after I retired from the USAF base I had a daylight sighting on three different occasions and three different UFO's. There was no mistake in identity. I became a confirmed believer since then.

I hope my report is self explanatory if you need anymore particular data please let me know.

This was a definitely controlled by some outside sources fireball judging from the entry and pathway it had taken.

It entered the EAST screened-in open window with a low window sill about two feet above the ground dirt level, coming in straight then slightly angling just skimming my both knees by an inch forcing me to pull my knees inwards, against the chair. The fireball made a right 90⁰ degree turn into the hallway then made another 90⁰ degree turn to left to go out the hallway window which is also screened. There was no damage to either window screens. My first reaction was to turn the electric power off at the master box because the electric 220V stove was being used

I was sitting in a wooden chair talking with my wife who was preparing a snack on the stove and she was standing near the stove. The kitchen area was small.

My wife in the past mentioned about 6 " to 8" balls of fire going through that window and panicking her but it was difficult for me to digress not ever being exposed to anything like it in the past.

I have seen a lot of lightening in my life and trees split in half. Living in the tropics most of my life with heavy rainfalls and thunder clouds never scared me as this strange phenomena called fireball by me.

Sincerely YOUNG,



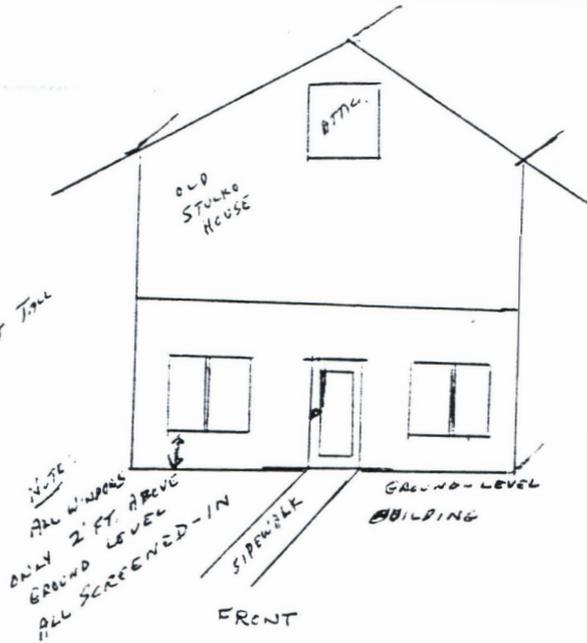
Hillard J. Piekos
P.O. Box 1552
North Riverside, Illinois
60546

↑
- S -

SMALL OLD STUCKO HOUSE

HEAVILY-WEEDED

HEAVILY-WEEDED
AUSTRALIAN
PINES
50'-90' FT TALL



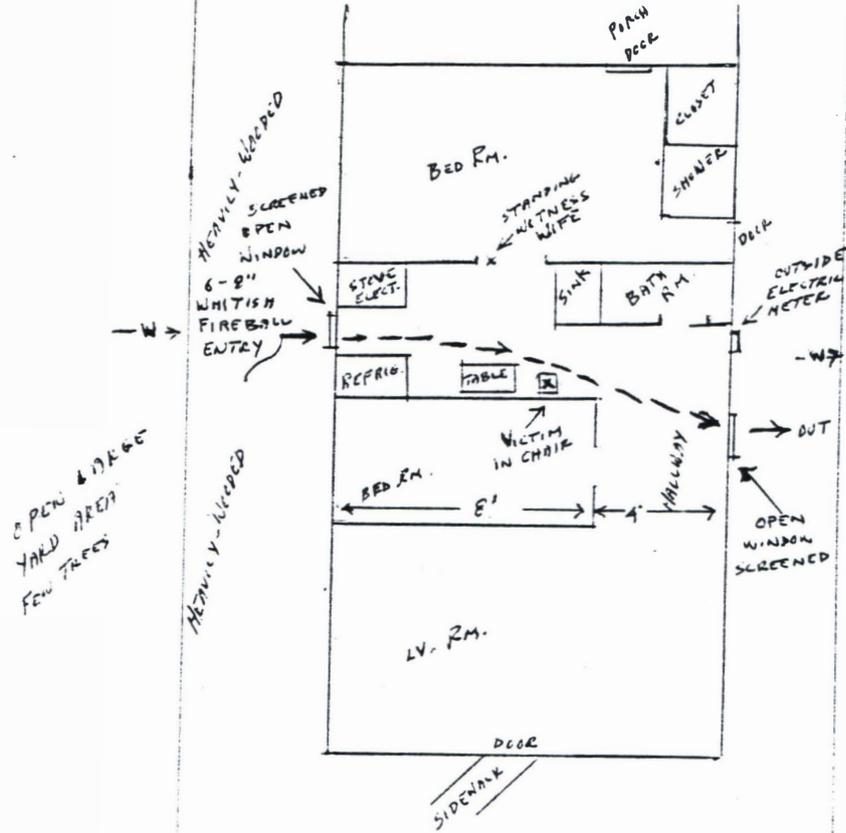
20 NE-15-ST. (KINGS ROAD)
HOMESTEAD, FLORIDA

↓
- NORTH -

↑
- S -

DIAGRAM OF INTERIOR OF HOUSE

WHERE A 6" TO 8" INCH WHITISH
FIRE BALL ENTERED & LEFT
NO BURN MARKS



↓
- NORTH -

601 0061

The Cambrian News 14.11.1986

A mine of experience

As I'm not listed under 'Llowarch' in the phone book, I'll bet some distant relatives of mine in the marches are troubled sometimes by people wanting me. Anyway, some people do manage to penetrate my security barrier and, in the case of one chap - "just call me Jeff" - I didn't mind at all.

Jeff follows the progress (if such it is!) of this column and read my piece on Sion y Gof, the blacksmith executed on Pencrocbren. It prompted him to tell me of a peculiar experience he had in the Dylife area back in 1984. Jeff doesn't live in that area but, when he can, shares my own enjoyment of "poking about in old places." Unlike myself, his pleasure includes going into old mine workings.

Dylife was once a famous mining village. The glory has passed but the shafts and levels remain, and I advise readers to avoid such places like the plague!

However, Jeff seems to know what he's doing and therefore went into a level with helmet and flashlight to see what he could see.

loud. At first, he thought it was somebody else in the tunnel with him. He called out, hoping for a reply. There was no response.

The humming continued. It seemed to be coming from the other side of the pool of water. He peered along the level, his torch piercing the darkness, but he saw nothing but blank rock.

Still believing that the humming came from someone else in there with him, he momentarily switched off his light, reasoning that anyone else in there would have a lamp and that its glow would be visible. About ten yards ahead of him he saw something.

"It was a white or a pale blue shape about the size of a small man. It gave off a sort of glow, but not like a torch."

Apparently, the whole 'figure' glowed, and it seemed to be the source of the humming. Startled, Jeff switched on his light again. There was nothing to be seen. Needless to say, our hero made a hasty retreat from the level. Coming into the daylight, he looked back and listened. There was nothing to see or

"I've often been in old workings," he told me, "and though they're often dark and damp, I don't find them eerie."

On the occasion about which he told me, though, he had quite a "funny" thing happen to him. Apparently in some workings there are noises at times. To the inexperienced, these noises could be disturbing but, I'm told, their cause is usually wind or running water.

So there was Jeff, helmeted, Wellied, flashlight shining, making slow progress along the dripping level. Bending because the rock roof was low, he came to a pool of water. He prodded at it with the stick he carries and felt it was safe to wade on. Above the puddle there was a shaft, perhaps a natural fissure leading upwards. He shone the torch to see what might be above him. Then he heard a noise. It was unlike anything he'd heard in old mines before.

"It sounded like a quiet humming," he told me over the phone.

"What, like a machine?" I asked.

"Oh, no. Like somebody's voice." The humming sounded close but not

hear.

"That evening, I was in the bar of a pub and got talking to locals about the old mining days. I didn't tell them about what happened to me, though."

As the evening ended, Jeff was approached by a man who, he guessed, must have been in his late fifties. Jeff had told the locals where he'd been exploring that day and the man had something to say about that part of the old mines. He would not reveal it in front of the others for fear of ridicule.

It seems that the older man, in his youth, had seen something equally odd. He - in the company of his young friends and on more than one occasion - had seen lights emerge from the mine level at night. These lights would rise into the air and move off through the sky but not quickly.

All very peculiar. Perhaps Jeff's "phantom hummer" and these flying lights have a connection. Perhaps, too, someone has more information about them. Both Jeff and I would like to know more.

Weird Wonders of Wales by LLOWARCH

[Janet Bord]

bo1 0062

THE MIN MIN LIGHT

By PAM SHILTON

For as long as camp-fire tales can recall and Aboriginal legends before that, the Min Min Light has appeared and disappeared mysteriously in the quiet outback of Queensland. Way "back o' beyond", around Boulia and Winton, there appears from time to time an unmistakable light - a luminous fluorescent shape that fades and brightens, recedes and advances across the flat never-ending plain. It has mystified men for centuries. It fascinates. It begs you to follow. And it can be eerie and frightening on that lonely dark plain late at night.

The old tribal Aboriginals on the edge of Arnhem Land have always revered the Min Min Light, but they do not wish to talk about it. It occupies some special place in their beliefs which cannot be explained to skeptical and insensitive white men who come in search of it. Dozens of these men have chased it (or been chased by it) on horseback across the plains. Others have tried to "run it down" in jeeps and motorcycles, some have shot bullets at it, and TV crews and scientists have stayed long and lonely nights in vain trying to film the phenomena. One Townsville priest was curious enough to chase it all one night in his motor car without success.

The campfire yarns of the old bushmen say the Min Min derived its name from a notorious old pub which once stood in the area. The Min Min hotel had a graveyard nearby wherein were interred many who met their often untimely deaths in the wild west of Queensland's early days. The pub was reduced to a ruined heap of tin and bottles by 1918, but its name was bestowed on the mystery light which was known in the vicinity. The light was also known as the Warena Light. Warrenda, nearby, was at one time the biggest station in Queensland.

What the light is, is another matter, for a controversy has waged about it for years. Some explanations of the phenomena include claims of static electricity caused by the wings of millions of midges or other small flying insects, lightning flashes and fire balls, and flights of owls with luminous feathers. It has been likened to the ignis fatuus ("foolish light"), the "will-o'-the-wisp" or "corpse candle" which occurs regularly and just as unpredictably over marshy grounds or in graveyards in certain parts of Britain and the continent. It is explained as being the flame of burning marsh gas (largely methane) which has been ignited by hydrogen phosphide contained in decaying organic matter. To those who have seen it, these explanations do not seem plausible.

Observers say the light is of oval shape. It is said to move in irregular circles and spirals, sometimes straight upwards to a height of 300 m and then descend to the ground. One witness claimed the light to have "zig zagged along a ridge until it reached a tree, and then it illuminated the trunk, rose among the branches, and emitted an eerie greenish glow about a metre in diameter. After that it travelled about 100 metres away, only to return and pass through the branches of the tree without illuminating the trunk."

Another witness, a stockman who was scared out of his wits by the strange light, put it this way: "About 10 o'clock this evening I was riding not far from the Min Min graveyard when all of a sudden, I saw a strange glow appear right in the middle of the cemetery. I looked at it amazed. The glow got bigger, till it was about the size of a watermelon. I couldn't believe my eyes as I saw it hovering over the ground. Then I broke into a cold sweat as it started coming towards me. It was too much for my nerves. I was terror stricken. I dug the spurs into the horse and headed towards Boulia as fast as I could. But every time I looked back over my shoulder I could see the light following me. It only disappeared when I got to the outskirts of the town."

There are further observations, one by a witness in 1912, which makes one ponder further over the scientific explanations. He was travelling from Warena to Slashers Creek on horse-back when he had his encounter with the Min Min Light. He wrote of his experience:

"Cars weren't common in those days. There were only two or three in the district. Even so, and though I wasn't used to them, that light didn't resemble a car light. It was too green. It floated rather than travelled. It was too high above the ground to come from a car. It cast a glow all around instead of cutting a straight line ahead. I had a look at the mare. Nellie wasn't a bit perturbed. She didn't even lift her head or prick her ears or have a look at this thing coming towards us. I knew, had it been a car, that mare would have been afraid . . . I tell you honestly, Nellie never paid the least attention to that light."

"I tried her a couple of miles later. I struck a match to light a cigarette. The start that mare gave when the match flared and again when it went out, was the usual one of a horse unused to lights at night. Yet that ghost light, or whatever it was, didn't make her turn a hair or lift an ear."

But the Min Min Light is not just a legend of the past. In 1980, two correspondents, Mr. O. W. Marlay and Mr. Mick Power, who spent many years in the area of the Min Min Light wrote to me telling of their experiences of having sighted the phenomena. Mr. Powell had this to say: "I have seen it (the light) many times and I know that country . . . I first saw it in 1920 when I was travelling with a mob of horses and camped on the west of the Diamantina River. There were three of us who saw it. It did not distract any of the horses and they were mostly yearlings. We saw it (the light) every night but never closer than 40 miles off Boulia or any closer to Winton than Elderslie Station."

Transair, TAA, Melbourne.

Journal of Meteorology' vol 8., 1983

[V-J. BALLESTER OLMO]

bol 0063

BALL LIGHTNING STRIKES TWICE*

By B.H. BAILEY

Atmospheric Sciences Research Center, State University of New York at Albany

THIS article presents written accounts of two separate experiences with ball lightning by Mrs Patricia Townsend, a resident of Haymarket, Virginia, USA. These experiences are unique in that they occurred in the same room of a home in two consecutive summers, were observed by the same person, and in both cases, the ball lightning struck the person.

These incidents took place during thunderstorm activity in the summers of 1977 and 1978. Written accounts by the witness of both encounters were prepared within a week of the second event, following a phone conversation with the National Weather Service office in Silver Spring, Maryland. The exact date of the first incident cannot be recalled, although, according to the witness, it probably occurred in June and was definitely on a Sunday. The second event took place on 21 June 1978 at approximately 630 pm Eastern Daylight Time (EDT).

Mrs Townsend claims her recollection of the first event, which occurred approximately one year prior to her narrative, is better than of the more recent one "because I didn't know what it [the ball lightning] was and was more curious than frightened. The second time it happened my only thoughts were to get away from it if I could." She states that she had never seen nor heard of ball lightning or fireballs before these events.

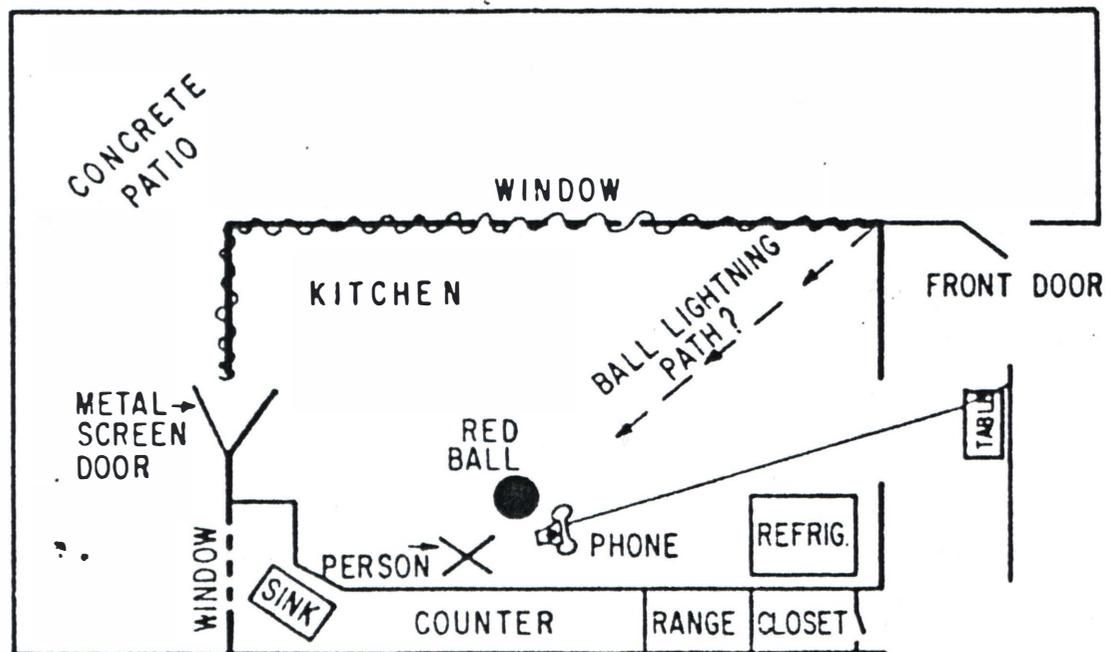
The following material presents the complete, unedited descriptions of the ball lightning experiences as prepared by Mrs Townsend. The figures were redrawn for publication from her hand drawings.

THE FIRST INCIDENT - SUMMER 1977

"As best as I can remember, the time this incident occurred was in the morning, a Sunday morning. My son had just left our church and I had called the mother of his girlfriend to double check the time they would be returning from the church buffet to be held after the services. At the time my son left, a severe storm was threatening. The girl's mother talked to me quite a bit longer than I had anticipated so by the time the lightning struck me the storm was in full force; wind, heavy rain, lightning and thunder. As I have indicated on the sketch attached, I was standing in my kitchen leaning against the counter between the sink and the range. I am indicated by the X. My phone has a thirteen foot cord and this enables me to carry it into the kitchen.

* As with many accounts of what are supposedly ball lightning events, one has here only descriptive information from a single person. The possibility remains that the individual has suffered illness, hallucination or some form of optical illusion, so the decision whether or not to publish articles of this sort is difficult. However, if ball lightning *was* present, its repeated occurrence in one location should not go unrecorded—EDITOR

INCIDENT NO. 1, SUMMER 1977



"Several things happened at the same time and the whole incident probably lasted no more than a few seconds at the most. While I was on the phone, I heard a tremendous crack, something like the retort of a high-powered rifle or the sound of a bat hitting a baseball. At the same time the outside of my house, meaning the outdoors, lit up brilliantly. A split second later or perhaps at the same time, I heard a loud swooshing or hissing noise and the phone seemed to come alive in my hand. Then my whole kitchen lit up like a floodlight. Lightning or electricity or whatever it was seemed to flow rapidly from the open kitchen door across the expanse of the far end of my kitchen to ceiling level as shown by the jagged line in my drawing. I'm not sure where the red ball came from but I have it depicted as coming from the jagged lightning on my ceiling. Anyhow, almost at the same time as the lightning zoomed across my kitchen and the phone started vibrating in my hand, a large red ball (with yellow and white somewhere) appeared in front of me and hit me on the chest with the force of a large man hitting me with his fist. I fell to the floor and I believe the phone was still in my hand. I'm still not sure if I was knocked unconscious or not. I couldn't swear I was and couldn't swear I wasn't. The ball hit me with the accompanying sounds of smacking and crackling, kind of like a string of firecrackers being set off.

"I remember being very frightened as I lay on the kitchen floor. I also remember sitting up and leaning against my kitchen cupboards approximately at the same X on the drawing. I sat for quite a while and when I gathered enough courage to pick up the phone, thinking I'd better call for help, I found the phone dead. I remember being quite dazed and disoriented and with a great effort I made it into my living room where I laid on my couch. I might have been in a kind of shock because I didn't feel any pain in my chest for a good hour or so after the lightning struck me. By the time my son arrived home from church, the pain in my chest was pretty bad. By the next day, the pain had subsided quite a bit but it didn't completely go away for several days.

"I'd like to add that I don't remember what I was wearing and also that I don't remember if I smelled any particular odor in connection with the ball. I'd also like to add that the ball appeared to be made of a soft burlap type material with a fuzzy texture."

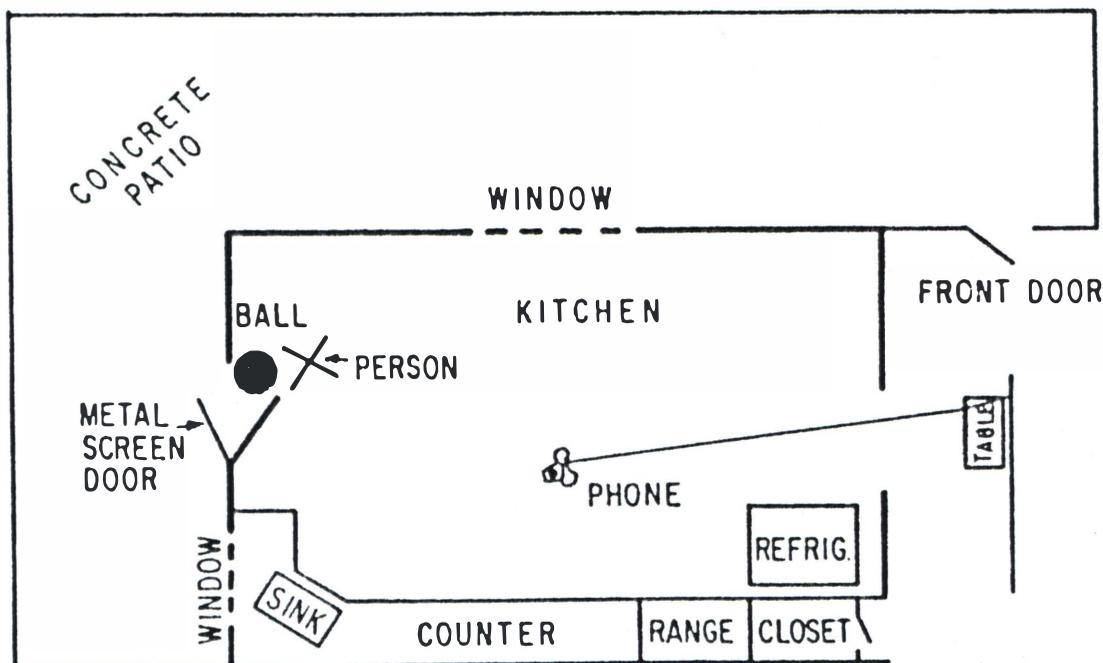
THE SECOND INCIDENT - 21 JUNE 1978, 6:30 PM

"My son had eaten earlier than myself and was preparing to run to a friend's place to play cards. I was standing in the kitchen preparing a light meal for myself when he left. It was already raining quite heavily at this time although the lightning and thunder were not that severe. When he left, he forgot to close the storm door and because the wind was pretty stiff, I wasted no time running to the kitchen door, stepping outside and pulling the door shut. The phone, although I wasn't using it, was in the middle of the kitchen floor, as indicated by my drawing. I was going to call my parents in Pennsylvania.

"Just as I released the storm door handle, and was still facing the patio around my kitchen, I heard a tremendous hissing sound, with crackling undertones and the outside lit up, again like a floodlight. I was already backing away from the storm door and about to reach for the kitchen door to shut it when this happened. At the same time a fireball somehow entered the kitchen and appeared in front of my face. It could have been any size, but my best calculations are that it was about a foot across with jagged yellow and white edges. This is probably erroneous because I had only a fraction of a second's time from the time I saw the ball until it hit me.

"I know I yelled just as it appeared and really didn't have time for anything else because as soon as I saw it, it hit me in the face with great force, sort of like someone hitting me in the face with an open hand. The sound it made when it hit me was like that of rifle fire. The sounds I heard inside my head were like crackling and spitting. My ears felt like they were full of fuzz and my whole head felt blown up and pressurized or something like that. Also my bones felt as though they had melted away and I started falling backwards. I didn't have any strength to break my fall and my whole body felt numb and far away.

INCIDENT NO. 2, JUNE 21, 1978



"I fell backwards onto the kitchen floor. I felt as though I was falling in slow motion and the complete silence after the fireball hit me was astounding. I think it may have affected my ears for a few minutes. I believe I must have had my eyes closed because when I opened them I could at first see nothing but black shadows lined in jagged white rims and the white rims were moving like little pieces of lightning. In a sort of daze, I

made my way into the living room and it was a good half-hour to an hour before I could see properly again. This time I felt only slight pain in my face, but the back of my head and my neck felt strained for the rest of the evening. I was very muddled in my brain until midday the next day. I found my speech very slow and slurred when my son came home and I tried to explain to him what happened.

"When this happened the only metal I was wearing were rivets and one button on my jeans and four metal hairpins in my hair.

"Again I don't remember any particular odor in connection with the ball. Thinking back on it now, I do seem to remember a peculiar taste in my mouth, kind of acidity or maybe sour and also that my throat felt dry and slightly sore. Again the ball appeared to be made of a fuzzy textured fabric, somehow dull surfaced yet luminous."

FOLLOW-UP INFORMATION

This investigator learned of and received copies of Mrs Townsend's descriptions, which were forwarded from the National Weather Service, in the autumn of 1978. This investigator prepared a number of follow-up questions and mailed them to her in December 1979, and her responses were received in January 1980. The following paragraphs summarize further information pertaining to the home's setting and the physical effects on the witness.

Setting: The house is in a wooded neighborhood in the foothills of a mountain. There is no antenna on the house nor other tall metallic objects adjacent to the house. The power line to the house runs about six metres from the kitchen door to a rear telephone pole, and connects into the back of the house. The house is not the highest object around.

The residence is a brick structure with metal storm windows and doors. The roof is asbestos shingled; the walls and ceiling are drywall; the kitchen floor is linoleum. Underneath the kitchen is the furnace and central air-conditioning unit.

Physical effects: There were no visible effects on her body or clothes. She was not examined by a doctor following either incident, although she spoke by phone with one following the 1977 event. The doctor did not really believe she had been hit by lightning.

After writing her narrative, Mrs Townsend recalled an odor associated with the 1978 event; that of a match that has just been struck.

A THIRD OCCURRENCE?

As a footnote to this investigator's questionnaire, Mrs Townsend hinted that a third ball lightning event in her kitchen could have occurred in the summer of 1979. Her unedited version follows:

"I didn't mention this to anyone before and I didn't want to mention it because I'm not really sure, but again this summer I believe lightning entered my house. I was upstairs cleaning my bedroom. My dog was with me and both of us heard loud crackling noises and a sort of muffled explosion coming from downstairs in the direction of the kitchen. This was during a very active thunderstorm. My dog ran to the top of the stairs. I wasn't so brave and stood in the doorway to my bedroom peering down the stairs. I can tell you I was scared to death I'd see another one of those things. I waited five minutes. My dog gave up long before that and went back into the bedroom to lay on my bed. I then went downstairs to check things out but could find nothing to indicate lightning had been there. Nothing was burned or looked out of the ordinary. Of course, nothing had been burned the two previous times either. No one else was in the house and I could find no explanation for the noises I had heard. I'm pretty sure it was lightning again but as I said before I hadn't seen it.

"I made a mental note not to mention it to anyone and consequently I've completely forgotten even the month it might have happened."

'Weather' vol 39. no 9. (Sept 1984)
[V-J. BALLBSTER ALMOS]

Clarke, D, & Oldroyd, G, **SPOOKLIGHTS** (1986)

Index prepared by Nigel Watson (copyright)

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page	date	time	place	event
1	6.1911	1235	Ashkirk, Selkirkshire	light at 10-15 m height
2	lat 8.1900	2030	Carnoch Hse, opp. Invercoe, Scotland	
3	29.7.1909		New Zealand	'Jack in the lantern' during airship scare
	Winters 1865-6		Whitburn, Durham	Lights off coast mistaken for lighthouse
	30.11.1866	1800	30 km S of Tyne	'Margaret and Jane' run aground at Whitburn
3-4			Fenlands, Norfolk	
			Broads, Herefordshire	Legends
4-5	early 12,1912		Ireland, Church I, Lough Beg, Co. Derry	lights ditto
5	1906-12		Lough Erne, Co. Fermanagh, Ireland	
	Easter			
	Eve, 1910	2330	ditto	ditto
	1.9.1912	2130	ditto	ditto
6	3.1849		ditto, Slavin Rock	ditto
	winter 1912		Bally Bay, Co. Monaghan, Ireland	
	1.1.1913		Enniskillen, Co. Fermanagh, Ireland	
	1879-80		nr R. Thames, S. Bucks	lights
7-8	25? .6.1915		nr Ashburton, Dartmoor	ditto
8	6.1915		Sherril, nr Hexworthy, Dartmoor	
	mid-8.1915		Dartington Manor, nr Totnes, Dartmoor, & Barton Pines, nr Paignton	
8-9	4.9.1915	2130	Dartington, Dartmoor	'airship' lights
9-10	31.1.1916	2025	biplane from Hainault Farm, Essex	lights
10	31.1.1916	2045	biplane from Rochford 1897	ditto
			West Bilney Hall, nr Kings Lynn, Norfolk	Luminous owl killed
11	3.2.1907		Twyford Hill, Norfolk	Luminous owl scare
	1.12, 1907	1945-		
		2230	Twyford Hill	ditto
	22.12, 1907	1900	nr Chop Lodge, Twyford	ditto
11-12	29.12.1907	2000	nr Twyford church	ditto
12	25/26/27.12.1907		Haddiscoe Dam	ditto
	7.1.1908	2030	Palmer's Field, nr Twyford	ditto
	ditto		Blyths Stacks, nr Twyford	ditto
	24.12.1905	2400	Aylsham, Norfolk	ditto
13	16.1.1908	0600	Adams Ground, nr Twyford	ditto
	1866		Twyford area	ditto
	summer 1898-			
	autumn 1899		Greystoke & Skelton, Cumberland	ditto
			Cartmel, N Lancs	'Ghost of Dobbie Lane')

14			Solway Mosses	luminous owl
			Hills near above	ditto
	1641		Montpelier, France. & Montebello	luminous birds killed
15	5.2.1908	1800	Lower Hellesdon, nr Norwich	ditto
15-16	2.1892		Shropshire	luminous owls seen
16	12.12.1907	0400	Wells Bar, Norfolk	blue fire in the wind
	5.2.1908		Foulsham	luminous owl scare
	6.2.1908	2200	Twyford ?	ditto
	9.2.1905		Foulsham	ditto
	17/19/14.1			
	& 4.2.1908		Twyford ?	ditto
17	12/19.2.1908		Haddiscoe Marshes	ditto
	3.1908		East Dereham, Norfolk	ditto
	1/2/5/10/12/28.			
	3.1908		Twyford	ditto
	28.4.1908		Twyford	ditto
	3.5.1908	2300	nr Twyford	ditto
	2.1909		Twyford	ditto
	9.1909		Spain	ditto
17-18	pre-1913		Portrush Road, Belfast	ditto
18	15.2.1921		Haddiscoe Marshes	ditto
	22.2.1922		Rushall, W Suffolk	ditto
19-20	23.12.1642		Edgehill	Ghostly battle
20	24.12.1642		ditto	ditto
	1950s		ditto	Black dog, lanterns, cloaked figures
	1875		Long Compton, Middle Tysoe	witchcraft
	1886		Fenny Compton	ritual murder
20-21	bef Xmas 1922		Burton Dassett nr church	lights (ghost)
21-22	early2 '23	1900	Hills nr Fenny Compton	ditto
22	Dec '22-Feb '23		Dassett Hills	ditto
	early2 '23		Vicarage	ditto
	11.2.1923	0200	Between F.C. & B.D.	ditto & figure
	2?.1923		Between F.C. & Knightcote, 'The Granclets' pool	ditto
	1 02 2.1923		Burton Dassett	ditto
23	2?.1923	2400	Knightcote Turn	ditto
	13.2.1923		Knightcote signal box & Fenny Compton	ditto
24	14.2.1923		Burton Dassett	ditto hunt
24-5	16.2.1923	2400	B.D. & Beacon Hill	ditto
25	ditto		Bishops Itchington	ditto
	2.1923	2200	Harbury	ditto
26	pre-1923		Foxcote Big pool	'Jenny Pinkett' ditto
28	1914-18		Fenny Compton district	'enemy airship' lights
28-9	19.2.1923		Beacon Hill, B.D.	lights
29-31	17/18/19.2.1923		Farmhouse, B.D.	ditto
30	1921		B.D. church	luminous owl / theory
31				'Jenny Burn Tail' lore
	4.3.1923		B.D., near church	light
31	2/3.1923		Beacon Hill	light guides lost
				motorist to his car

31-3	autumn 1920s	B.D. vicarage	spiritual guiding light seen several times ; locals skeptical
33-4		Fenny Compton area	local legends - fairies, treasure &c.
34	late 2.1924 26.1.1924	0615 Fenny Compton Worcs, Herefordshire	Ghost assoc. with death Earth tremor assoc with flooding
		North Scotland	auroral lights
	ditto	am, night Burton Dassett	light
34-5	ditto	night near Northend	light
35		B.D. light linked with tremors	
35-6	90 yrs pre-1923	Fenny Compton	lights
36-7			marsh gas theories for will-of-the-wisp
37			ball lightning, owls, St Elmo's fire
37-8	pre 1919	nr Keswick, Lake District	w.o.t.w.assoc with megaliths, lights
	1889	Carnac, Brittany	lights assoc stones
38	1904-5	North Wales	lights assoc religious revival ; social phenomenon
	1694, 1875	Harlech district, Dysinni Estuary, Wales	lights seen at sea
39	2.1905	Rhymney, Salvation Army Barracks, S. Wales	apparition & light fireball(s)
	13.2.1905	2000 Leeds	
	15.2.1905	Barmby Marsh, nr Howden, Yks	oblong light
39-40	11.2.1905	2230 Rawden & Yeardon, Yorks	bright flash of light
40	ditto	2340 nr Knaresborough	strange light
	ditto	2245 Embsay, Yorks	shower of stars
40-1			lights a form of intelligence ?

A NOTE ABOUT TWO SIGHTINGS PUBLISHED IN THE SECOND FASCICULE OF "BOLIDE"

Claude Maugé

Durtal (bol-0033): All the details of the observation do fit the Moon hypothesis: form ("big ball"); colour (red); immobility during 10 minutes; meteorological conditions (clouds with gaps); dark bars "on" the object and mode of disappearance (= clouds); position of the "UFO" exactly coinciding with the position of the Moon, which is not sighted by the witnesses. Conversely, both the arguments against the Moon hypothesis are flimsy: the witnesses are country people who "cannot" confuse the Moon and a UFO; the observation of the investigator, a month later, is the concern of true experimental method, but we have no indication of the meteorological circumstances this day, therefore the differences with the Durtal sighting don't exclude the Moon as stimulus for the original observation.

Yffiniac-Rennes (bol-0036): Mr. Barrier's investigation for GEPA leads R. Fouéré to be inclined to favour the Venus hypothesis (see Phénomènes Spatiaux's paper); yet R. Fouéré is far from to be a primary debunker. This sighting is only one of the many examples of the "chasing ball syndrome" caused by an astronomical stimulus.

Both these affairs are interesting, because they pose the problem of the kind of cases which deserve the attention of Bolide. The latter is particularly worthy of interest: the clipping which presented the sighting was entitled "A strange luminous phenomenon in Brittany sky: a ball of fire chased the Brest-Paris express". But this "fire"ball (not in the sense of "meteor") was Venus! Therefore a question: is any NL, any "fire"ball, worthy of Bolide? Or must we limit us to some specific kinds of sightings? The huge number of NL reports seems to impose the answer.



Director
Dr. G. T. Meaden

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TORRO Hailstorm and Tornado Research Divisions

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Dear *Hilary Evans*

BALL LIGHTNING NEWSLETTER

BLN was originally conceived as a medium through which those involved in research into ball lightning could communicate. Unfortunately, very few contributions have been received for publication, even though fairly strong support has been received in the form of regular subscriptions. In balance, however, it is felt that a more effective means of publication of the work of the TORRO Ball Lightning Division would be the **JOURNAL OF METEOROLOGY**, edited by Dr Terence Meaden. Publication of the BALL LIGHTNING NEWSLETTER has therefore been discontinued with immediate effect, the final issue being BLN6. Regular reports will now appear in the **JOURNAL OF METEOROLOGY**. You are therefore urged to subscribe to the **JOURNAL** if you do not already do so. A complimentary copy of the first issue of the **JOURNAL** containing a report of the TORRO Ball Lightning Division will be sent to you in due course if you are not already a subscriber.

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Yours sincerely

Mark Stenhoff

Mark Stenhoff, Director, TORRO Ball Lightning Division