BALL LIGHTNING BIBLIOGRAPHY

1950 - 1960

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INTRODUCTION

This bibliography contains 43 annotated references on ball lightning which, for the most part, were published originally in the period 1950-1960. It serves essentially to up-date the bibliographies of Aniol and Brand (items 2 and 7).

In addition to an annotation, each entry contains a translation of the title and, where pertinent, a transliteration of the title together with an indication of the language of the original publication. All items are in the Library of Congress with the exception of numbers 4 and 7, which are held by the Weather Bureau Library; the Library call number of each is included where available.

Copies of this bibliography are available upon request from the Science and Technology Division as long as the limited supply lasts. Readers knowing of additional references in this subject published during the appropriate time period are invited to submit them to the Science and Technology Division, Library of Congress, Washington 25, D. C.

John Sherrod, Chief
Science and Technology Division

1. Aliverti, G., and G. Lovera
BALL LIGHTNING OBSERVED IN UPPER ITALY. (Uber einige in Oberitalien beobachtete Kugelblitze; Text in German). Archiv für Meteorologie, Geophysik und Bioklimatologie, Ser. A, 3(1/2): 77-83, 1950. 3 refs.

DLC, QC851.A73

Existing theories are reviewed, and six cases of ball lightning observed in Italy are described. The theories considered include: the mechanical (eddy movement); thermal; electrical; and chemical (presence of substances which are capable of producing an exothermic reaction). None of these theories permit an explanation of all the phenomena involved. Of the six cases of so-called ball lightning observed, only one case can be verified as actual ball lightning. It was observed to enter a room through a window, travel along the window frame, and then disappear, leaving a burnt smell behind. The ball was about 12 cm. in diam., yellow, and moved noiselessly.

2. Aniol, R.
BALL LIGHTNING. (Der Kugelblitz; Text in German). Meteorologische Rundschau, 7: 220-222, Nov./Dec. 1954. 45 refs.

DLC, QC851.M2843

The general characteristics of ball lightning as determined by W. Brand are outlined, the various theories advanced since 1923 are reviewed, and existing authenticated photographs of ball lightning are mentioned. A bibliography is included covering the literature published from 1923 to 1954, after the appearance of Brand's book.

3. A BALL LIGHTNING OBSERVATION AT COTTBUS. (Kugelblitzbeobachtung in Cottbus; Text in German). Zeitschrift fuer Meteorologie, 9: 378, Nov./Dec. 1955.

DLC, QC851.Z4

A glowing ball, the size of a fist, was observed to move rapidly in a straight, perpendicular line toward the ground near a stairway leading from the outside toward a cellar. The ball was of a luminous copper to fiery orange color. As soon as it hit the lower platform of the stairway, it burst with the sound of a simple detonation, giving off heat and a strong smell of sulphur.

4. Baratoux, M.
OBSERVATION OF BALL LIGHTNING FROM AN AIRPLANE. (Sur une observation de "foudre en boule" faite en avion; Text in French). La Meteorologie, 4th Ser. no. 28: 164-166, Oct.-Dec. 1952,

DWB

A detailed account is given of ball lightning observed from an airplane at an altitude of 3400 m. near Cairo (Egypt). A ball of fire about the size of a tennis ball was observed to follow along at the side of the plane without touching it and then explode like a gun. Before the ball lightning was observed, the plane was subjected to a slight jolt followed by a bumping sound.

5. Benedicks, Carl
THEORY OF THE LIGHTNING-BALLS AND ITS APPLICATION TO THE ATMOSPHERIC PHENOMENON CALLED "FLYING SAUCERS". Arkiv foer Geofysik, 2: 1-12 incl. illus. 1954. 12 refs.

DLC, QC801.A7

Some early accounts of ball lightning (lightning balls) are reviewed, including Arago (1838), Schmid (1860), Haidinger (1868), Hesehus (1901) and Arrhenius (1912). Early descriptions of "flying saucers" are also reported, and a possible close relationship or identity between the phenomena is implied. Instances of two fatalities under strange circumstances are reported, that of an aviator in Europe (1948) and a woman in St. Petersburg, Florida (1951), which were probably due to ball lightning. A theoretical explanation of ball lightning is also given which is based on thermal dissociation of water at high temperatures. Water vapor in the path of lightning may be completely dissociated to oxyhydrogen. The cylinder of gas so formed would then contract into a series of smaller balls (pearl lightning) and finally to a few larger ones (ball lightning). This over-heated mass of gas will explode when the mass as a whole reaches sufficiently low temperature (below 3500°C).

6. Berlage, H. P.
BALL LIGHTNING, LUMINESCENT POTATOES, AND WEATHER. (Van bliksemballen naar lichtgevende aardappels en weer terug). Hemel en Dampkring, 53, no. 4: 65-70, Apr. 1955. 14 refs. (Text in Dutch)

DLC, QB1.N43

A detailed account is given of ball lightning written by E. Mathias, together with descriptions of a series of ball-lightning incidents that have occurred in the Netherlands over a period of years, primarily from 1916 to 1943. Several theories on the origin of ball lightning are summarized.

7. Brand, Walther
BALL LIGHTNING. (Der Kugelblitz; Text in German). Hamburg, Verlag von Henri Grand, 1923, 170 p. incl. illus. graphs. [250] refs. (Probleme der Kosmischen Physik, v. 2/3).

DWB, M1635 B817

A systematic study is presented based on published accounts and analyses of about 600 records of ball lightning observed from 1665 to 1920. A summary of 215 selected records is given. The bibliography included constitutes the most comprehensive bibliography on the subject published to date.

8. Chirvinskii, P. N.
FIRST OBSERVERS OF BALL LIGHTNING. (Pervye nabliudateli sharovykh molnii; Text in Russian). Priroda, 43, No. 8: 116, August 1954.

DLC, Q4.P8

A brief reference is given to the first description of natural ball lightning by the Roman poet Lucretius [60 B.C.], and to an eyewitness account of the first successful Russian experiment to produce artificial ball lightning which killed Rihman, one of its creators.

9. Dauvillier, A.
BALL LIGHTNING AND THERMONUCLEAR REACTIONS. (Foudre globulaire et reactions thermonucleaires.) Academie des Sciences, Comptes Rendus, 245, no. 25: 2155-2156, Dec. 1957. 1 ref. (Text in French)

DLC, Q46.A14

Ball lightning is explained as a form of C^{14} resulting from the action of lightning on atmospheric nitrogen. This natural thermonuclear reaction might be the only one possible on earth if this hypothesis is correct.

10. Dolezalek, H.
SOME OBSERVATIONS ON BALL LIGHTNING. (Einige Kugelblitz-Beobachtungen; Text in German with English summary). Geofisica Pura e Applicata, 20: 183-185, July-Dec. 1951. 2 refs.

DLC, QC801.G37

Five cases of unusual lightning phenomena are described in detail. Four were single cases of ball lightning, one was a double stroke of ball lightning (3 cm. and 10 cm. diameter, respectively). Several were heard to explode, and in one case the burned area where the explosion occurred was observed.

11. Gerasimenko, T. F.
BALL LIGHTNING DURING A WINTER THUNDERSTORM. (Sharovaia moiniia vo vremia zimnei grozy). Priroda, No. 7: 109-110, July 1956. (Text in Russian)

DLC Q4.P8

A detailed report, based on eyewitness accounts, is presented of three occurrences of natural ball lightning. Their contrasting behavior, destructive power, effects to persons and property, and the conditions under which the phenomena appeared on Dec. 9, 1955, in the Krasnodar region of the Soviet Union are described.

12. Grosu, St.
CONSIDERATIONS OF CERTAIN ATMOSPHERIC ELECTRICITY PHENOMENA. (Consideratii cu privire la unele fenomene din electricitatea atmosferica; Text in Rumanian with English and Russian summaries). Electrotehnica, 8(2): 57-62 incl. diagrs. Feb. 1960. 7 refs.

DLC

Various theories of atmospheric electricity phenomena are reviewed, and a theory of the nature of ball lightning is proposed. Ball lightning is believed to consist of a highly ionized gas in a plasma state, since it melts metals, or at least gives off extremely high temperatures as it loses its equilibrium on contact. The forces which hold the plasma together in a spherical shape are possibly of magnetic origin, the electrical charges being enclosed in a magnetic shell. The magnetic field may result from the movement of the electrically charged particles in circular trajectories.

13. Hill, E. L.
BALL LIGHTNING AS A PHYSICAL PHENOMENON.
J. Geophysl. Res., 65: 1947-1952, July 1960. 20 refs.
DLC, QC811.J6

A general historical review of ball lightning is presented. It is considered unlikely that ball lightning is a plasma phenomenon. The evidence suggests that it is a region containing a strongly inhomogeneous distribution of space charge in the form of highly ionized gas, the ionization being primarily in the molecular form, with few free electrons. The fireball probably does not represent a particularly unusual phenomenon except in the rarity of the conditions required for its formation.

14. IUr'ev, A.
THE SECRET OF FIREBALLS. (Taina ognennogo shara; Text in Russian). Komsomol'skaia pravda (Sunday Suppl.) Oct. 30, 1960. p. 3.
DLC

A case of ball lightning observed by a student in Stalingrad Province near midnight (no date given) is reported, followed by a brief discussion of the nature of this phenomenon. Ball lightning is attributed to the ionization and discharge of air resulting from an electric discharge causing a large energy concentration in a small space. The luminescence is due to the gradual transfer of energy to the free electrons of the surrounding air. Simple equipment has been developed for producing luminous fireballs about 1 cm. in diameter, although the method is considered of only theoretical interest.

15. Kapitsa, P. L.
ON THE NATURE OF BALL LIGHTNING. (O prirode sharovoi molnii; Text in Russian). Doklady Akademii Nauk SSSR, 101: 245-248, March 11, 1955. 7 refs. (English translation by Consultants Bureau, N. Y. as Soviet Research in Physics, Collection No. 3, Paper No. 5: 17-20, [1956?])

DLC, AS262.S3663

The exact nature of ball lightning is unknown since attempts to produce artificial ball lightning have been unsuccessful. A new theory is proposed which explains the phenomenon in terms of resonance absorption of a standing electromagnetic wave due to a conducting ionized sphere of plasma, occurring when the wavelength of the radiation is approximately four times the diameter of the fireball.

The phenomenon should appear in zones of maximum radio-wave intensity or at one or more antinodes (loops). Such a theory explains a number of observed characteristics of ball lightning, including relatively common size (10-20 cm.), slow motion, noiseless disappearance, and passage through walls of buildings.

16. Kogan-Beletskii, G. I.
ON THE NATURE OF BALL LIGHTNING (K voprosu o prirode sharovoi molnii; Text in Russian). Priroda, 46, No. 6: 71-73 incl. diagrs. June 1957. 1 ref.

DLC, Q4.P8

A vivid description is given of two occurrences of ball lightning including the meteorological conditions under which the phenomena appeared and the effects on the two aircraft involved. The first case involved a commercial airliner (Li-2) struck by ball lightning on 12 August 1956 in the lower Tambosk region of the Soviet Union and the second case a jet plane struck in December 1956 somewhere in the western part of the Soviet Union. The behavior of the ball lightning supports one of the theories of Kapitsa that as a plane flies through Cb clouds near the center of the storm, ultrashort radio waves falling on the conducting surface of the plane reflect from it, similar to the earth's surface, and thus create an intense electrical field, a condition necessary for the occurrence of ball lightning.

17. Kolobkov, N. V.
BALL LIGHTNING (Sharovaia molniia; Text in Russian). p. 47-50 incl. illus. diagrs. (In: Grozy i shkvaly. Moscow, Gosudarstvennoe Izdatel'stvo Tekhniko-Teoreti-cheskoi Literatury, 1951). [25] refs.

DLC, QC968.K6

A general discussion is given of natural ball lightning. Two of 10 known theories explaining the phenomenon are discussed but no complete explanation is known. An attempt is made to explain the nature of ball lightning in terms of eddy movement created between two oppositely directed electrical discharges of lightning and highly electrified ball-like mixtures of gases (ozone, oxygen, hydrogen). Three photographs showing the development of natural ball lightning are reproduced. Problems of photographing the phenomenon are mentioned.

18. Kuhn, Erich
SNAPSHOT OF BALL LIGHTNING? (Ein Kugelblitz auf einer Moment-Aufnahme?) Naturwissenschaften 38, no. 22: 518-519 incl. illus. Nov. 1951. (Text in German)

DLC, Q3.N7

A photograph here reproduced shows what is apparently ball lightning that occurred at Ludwigshafen. The ball was observed to burst a few meters above the ground.

19. Lindemann, G.
INJURIES BY BALL LIGHTNING. (Verletzungen durch Kugelblitze; Text in German). Kosmos, 47: 380-381 incl. illus. Aug. 1951.

DLC, Q3.K8

Injuries to a number of youths while camping and probably due to ball lightning are described. A short, sharp explosion, accompanied by a bright light, was heard at the end of a thunderstorm. Several boys at a distance of 15 m. from the explosion were injured, one showing a pattern of branched lightning on his body. No air pressure or odors were experienced, nor were any other traces of lightning found.

20. Malsch, W.
OBSERVATION OF A WEAK TORNADO AND BALL LIGHTNING. (Beobachtung einer schwachen Trombe und eines Kuegelblitzes; Text in German). Meteorologische Rundschau, 9: 150, July-Aug. 1956.

DLC, QC851.M2843

Ball lightning was observed to strike an old horse-chestnut tree on May 24, 1956, near Karlsruhe. A brief description of the accompanying meteorological conditions is included.

21. Malsch, W.
OBSERVATION OF BALL LIGHTNING. (Beobachtung eines Kugelblitzes; Text in German). Meteorologische Rundschau, 9: 188, Sept.-Oct. 1956.

DLC, QC851.M2843

The ball lightning observed during a thunderstorm at Hodingen (Germany) entered a 2nd floor room through a small window four sec. after lightning struck the house. The ball, the size of a nut and of a greenish-yellow color, moved 1.5 m. into the room in two sec., rose to the ceiling and exploded, emitting reddish-yellow sparks. The movement of the ball seemed to be rotary. About five sec. after the first ball exploded, another similar ball entered the room and exploded against the ceiling, emitting a strong ozone-like odor. About two km. from Hodingen, a luminous arc was observed for half an hour near a high-voltage tower.

22. Margs, Bruno
BALL LIGHTNING. (Kugelblitz; Text in German). Meteorologische Rundschau, 9: 72, March/April 1956.

DLC, QC851.M2843

The ball lightning entered a room through a window during a severe thunderstorm. The ball was about 25-30 cm. in diam. and of a predominantly blue color. It moved rapidly and noiselessly in a straight line 4 m. toward the door, retreated slightly in front of a person standing there, and disappeared to the right through a slit in the door 5 cm. wide. No heat was generated by the lightning, but it emitted an odor similar to that of burned rags.

23. Moller, F.
WHAT IS BALL LIGHTNING? (Was ist ein Kugelblitz?; Text in German). Kosmos, 47: 86-87, Feb. 1951.

DLC, Q3.K8

The characteristics of ball lightning are examined on the basis of available descriptions. Observations indicate that there are two types of ball lightning. The first includes less luminous, glowing red balls which float freely in the air, retreat from touch, and disappear noiselessly. The second type includes blinding white or bluish balls which remain stationary or move along objects, cause severe burns or even death, and explode or disappear by emitting short radial lightning belts. To date, it has not been possible to duplicate ball lightning in the laboratory, and there is no generally accepted theory on its formation. A theory, based on the assumption that a conglomeration of positively charged gas ions and negative electrons, bound together by atomic forces, fill the ball, affords an explanation of many ball-lightning phenomena observed.

24. Nauer, Herbert
MODEL EXPERIMENTS ON BALL LIGHTNING. (Modellversuche zum Kugelblitz). Zeitschrift fuer angewandte Physik, 5, no. 12: 441-450 incl. diagrs. 1953. 21 refs. (Text in German)

DLC, TK3.Z43

A theory is presented for the explanation of ball lightning based on an observation by Hertz in 1883 that every strong initial discharge leaves a cloud which is luminous. Diffuse burning of dilute mixtures of various gases in air below the normal flash point was examined expérimentally. Combustible gases, especially methane, are present in nature, and ball lightning may be produced in this manner.

25. Nauer, Herbert
HOW DOES BALL LIGHTNING ORIGINATE? (Wie entsteht ein Kugelblitz?; Text in German). Umschau, 56: 75-77 incl. diagrs. Feb. 1, 1956. 1 ref.

DLC, AP30.U5

The general characteristics of ball lightning are outlined, the theories of Toepler and Walter are reviewed, and laboratory experiments are described. The experiments failed to substantiate the theories of Toepler (formation of an electrically conductive gas channel after an initial discharge and the liberation of electricity on both ends of the channel) and Walter (formation of an electrically charged water bubble during rain). A phenomenon similar in appearance and behavior to ball lightning was obtained by producing an electrical discharge in a glass tube containing a mixture of air and 4-9% hydrogen. The experiments indicate that the only conditions necessary in nature for ball lightning to form is a critical concentration of a combustible gas and an initial electrical discharge. The rare occurrence of ball lightning is attributable to the fact that the necessary concentrations of gases occur rarely under natural conditions.

26. Neunteuf, Josef
WINTER THUNDERSTORMS, ST. ELMO'S FIRE, AND BALL LIGHTNING. (Wintergewitter, St. Elmsfeur und Kugelblitz; Text in German). Wetter und Leben, 3: 49-57, March 1951. 13 refs.

DLC, QH543.W4

The general characteristics of the appearance,

behavior, and formation conditions of ball lightning are reviewed, and nine cases of ball lightning are cited fully from the literature or as reported by observers.

27. Petersen, Helge
BALL LIGHTNING. Geophysica, 5, no. 1: 49-50 incl. illus. 1952.

DLC, QC801.G38

An unusual photograph is reproduced of the erratic motion of ball lightning estimated to be about 5 cm. in diameter. The ball moved slowly, was caught in the downdraft of a cold chimney, and finally exploded in a fireplace. The data on this phenomenon occurring in Copenhagen, Denmark, were not recorded immediately.

28. Petersen, Helge, Robert M. Poulter, and others.
/PHOTOGRAPHY AND BALL LIGHTNING/. Weather, 9: 73, 121, 321; 10: 98 incl. illus. 1954, 1955.

DLC, QC851.W4

The authenticity is questioned of a photograph, reproduced earlier in Geophysica, purporting to show ball lightning. Two additional photographs are reproduced to illustrate the spurious effects that may be achieved. The controversy whether or not the initial photograph is authentic is not finally resolved.

29. Pflegel, Rudolf
OBSERVATION OF BALL LIGHTNING. (Beobachtung eines Kugelblitzes; Text in German). Zeitschrift fuer Meteorologie, 10: 347 incl. table, Nov. 1956.

DLC, QC851.Z4

A case of ball lightning observed in a meadow during calm, drizzly weather is described in detail. The ball was 15-20 cm. in diam. and appeared bluish-white at a distance of about 300 m. and red at 2 m. It was moving slowly at an angle of inclination of 30 degrees, bounced off the wet meadow to a height of 4 m., moved slowly along the wall of a barn, circled a tree, and exploded loudly when hitting a fence post. No evidence of the action of heat was found at the point of explosion, indicating that the disintegration of the ball occurred through internal collapse. After the disappearance of the ball lightning, ordinary lightning was observed to hit the barn causing fire.

30. Popov, IU. A.
LIGHTNING DISCHARGE ON AN AIRPLANE. (Razriad molnii na fiuzeliazhe samoleta). Priroda, 48, No. 12: 111-112 incl. diagr. December 1959. 1 ref. (Text in Russian)

DLC, Q4.P8

An eyewitness account is given of ball lightning (about 10 cm. in diam.) which struck a flying aircraft on April 23, 1959, over the Irkutsk region of the Soviet Union. Detailed meteorological data, and information on the effects of the lightning on the aircraft fuselage and instruments are included.

31. RECONSIDERATION OF THE BALL LIGHTNING AT LUTJEWOLDE. (Nabetrachting over de bolbliksem van Lutjewolde; Text in Dutch). Hemel en Dampkring, 49: 158. 1951.

DLC, QB1.N43

A brief report is presented of the phenomenon which occurred on Sept. 10-11, 1950. It was probably an intense form of St. Elmo's fire.

32. Řihánek, Ladislav, and Josef Postránecký
BALL LIGHTNING. (Kulový blesk; Text in Czech). p. 90-91, 463-478. (In: Bouřky a ochrana před bleskem, Praha, Nakladatelství Československé Akademie Věd, 1957). /60/ refs.

DLC, QC966.R5

A brief discussion is presented on the nature of ball lightning, including size, shape, color, behavior, and the conditions under which the phenomenon occurs. The lack of scientific knowledge regarding the phenomenon and the problem of producing artificial ball lightning are stressed. The theory of a Russian scientist, IA. I. Frenkel', explaining ball lightning in terms of the reaction of atmospheric gases to electrical discharges, is given. The references included in the article represent a good selection of publications on ball lightning from Western European and Slavic countries.

33. Rodewald, Martin
BALL LIGHTNING OBSERVATIONS. (Kugelblitzbeobachtungen; Text in German). Zeitschrift fuer Meteorologie, 8: 27-29, Jan. 1954. (Translation available as PB 59-10189)

DLC, QC851.Z4

A case of ball lightning which occurred in 1950 near Harburg, Germany, and was investigated by the author two days later is described, and nine letters from people having observed ball lightning are reproduced. In the first case, the lightning appeared suddenly on the tile floor of a kitchen in the form of a glowing yellow bubble about 10 cm. in diam. which exploded one sec. later, emitting a blinding light and sparks and filling the room with smoke smelling of burned powder. The only trace left by the ball was a white spot on the floor. At the time the ball lightning occurred, lightning struck a house 800-1000 m. away, and a bluish-white luminous sphere was observed to travel along an overhead electric line 200 m. away. The three phenomena seem to have been related.

34. Schonland, B. F. J.
BALL LIGHTNING. p. 50-52. (In: The flight of thunder bolts, Oxford, Clarendon Press, 1950). 1 ref.

DLC, QC966.S39

A general review of the nature of ball lightning is presented from a skeptical viewpoint. The lack of reliable observations and the difficulty of explaining the phenomena scientifically are used to support the hypothesis that most observed occurrances are an optical illusion or unusual cases of St. Elmo's fire.

35. Stekol'nikov, I. S.
BALL LIGHTNING. (Sharovye molnii; Text in Russian). p. 101-111 incl. illus. (In: Izuchenie molnii i grozo-zashchita. Moscow, Izdatel'stvo Akademii Nauk SSSR, 1955).

DLC, QC966.S B43

A general discussion of the phenomenon is presented together with detailed accounts of several occurrences citing general conditions, location, etc. The lack of scientific knowledge on the subject is emphasized. Several attempts to produce artificial ball lightning are described. Theoretical comparisons are made between the properties of artificial and natural ball lightning. It is concluded that ball lightning is a result of a certain required concentration of

burning gas (possibly hydrogen or oxygen) in a given air space. The light of the phenomenon has no connection with the electrical energy present; the electrical spark merely lights the concentrated gas. The unlikely presence of all the factors necessary to produce the phenomenon explains its rare occurrence. An illustration of ball lightning is given. Actual photographs of the phenomenon are seldom achieved.

36. Teich, M.
A BALL LIGHTNING OBSERVATION. (Eine Kugelblitzbeobachtung). Zeitschrift fuer Meteorologie, 9: 379 incl. maps, Nov.-Dec. 1955. (Text in German)

DLC, QC851.A4

A sphere the size of a football was observed to spiral slowly toward the ground and explode during a light thunderstorm on August 10, 1955, near Eichsfeld, Germany. The observer was knocked unconscious.

37. Thate, J. B.
BALL LIGHTNING AT WARNSVELD ON NOVEMBER 28, 1951. (Bolbliksem te Warnsveld op 28 November 1951). Hemel en Dampking, 50: 134-135 incl. maps, 1952. (Text in Dutch)

DLC, QB1.N43

A description is given of damage to houses in the vicinity of the explosion caused by ball lightning which struck a tree and then traveled some distance along the ground. The ball lightning was reported by observers to have been as large as a thumbnail, seen at arm's-length distance; it traveled from the clouds followed by a stream of light, and was surrounded by lightning-like extensions.

38. Toepler, Maximilian
LIGHTNING. (Blitze; Text in German). Naturwissenschaftliche Rundschau, 7: 326-333 incl. illus., graphs, diagrs. Aug. 1954.

DLC, Q3.N823

The formation of lightning is examined in detail, and the various forms of lightning, such as beaded

and ball lightning, are considered. Ball lightning is attributed to the formation of an electrically conductive gas channel after an initial lightning stroke in which an invisible weak aftercurrent occurs. At the point where a cloud-to-earth lightning discharge and a counter stroke from the ground meet, an afterglow in the form of ball lightning may persist for a time. The channel with the ball lightning may be moved by wind. Ball lightning is noiseless; the accompanying explosion or detonation is produced by the initial lightning. The phenomenon disappears when the supply of current ceases or when a second lightning discharge strikes the gas channel.

39. Tonks, Lewi
ELECTROMAGNETIC STANDING WAVES AND BALL LIGHTNING.
Nature, 187: 1013-1014, Sept. 17, 1960. 7 refs.
(Letters to the Editors)
DLC, Q1.N2

Theoretical problems arising from Kapitza's theory of ball lightning are outlined briefly. The inference is drawn that the combination of contributing factors required by the theory are unlikely to occur in nature. However, it is suggested that laboratory experiments could be designed to produce small fireballs.

40. Visser, S. W.
SOME REMARKS ON LIGHTNING FLASHES AND BALL LIGHTNING.
Meteorological Magazine, 86, no. 1025: 344-347, Nov. 1957. 3 refs.
DLC, QC851.M18

Ball lightning is attributed to the rapid cooling of a mixture of gases of positive and negative electrical charge. Two cases of ball lightning observed in Holland are described briefly.

41. Vonnegut, Bernard
ELECTRICAL THEORY OF TORNADOES. J. Geophysl. Res. 65: 203-212 incl. graph., diagrs. Jan. 1960. 43 refs.

DLC, QC811.J6

Possible relationships between atmospheric electrical phenomena and tornado formation are discussed. The intense electrical displays commonly observed in tornadoes are used as the basis for reviving theories suggested much earlier that the electrical

energy present in such storms is the mechanism responsible for the intense winds. Accounts of tornadoes often include reference to ball lightning and glowing or exploding fireballs. It is suggested that an understanding of ball lightning may be necessary to solve the puzzle of tornado formation.

2. Watson, W. K. R.
A THEORY OF BALL LIGHTNING FORMATION. Nature, 185: 449-450, Feb. 13, 1960.

DLC, Q1.N2

A brief review is given of Kapitza's standing electromagnetic wave description of ball lightning. It is shown theoretically that charged particles can be bound in the vicinity of the electric node. While Kapitza has suggested that fireballs should be found in the electric field antinode, the formation processes could be expected to take place at the electric node. On the basis of this treatment, standing wave frequencies on the order of 10^9 cm./sec. would be required to explain fireballs ranging in size from 10-20 cm. It is suggested that the theory could be examined in the laboratory.

3. Wolf, Franz
AN INTERESTING PHOTOGRAPH OF BALL LIGHTNING. (Interessante Aufnahme eines Kugelblitzes; Text in German). Naturwissenschaften, 43: 415-417 incl. illus., diagrs. Sept. 15, 1956. 10 refs.

DLC, Q3.N7

A photograph showing an erratic streak of light is reproduced and discussed. The photograph is believed to show ball lightning.