Report on Second International Symposium on Ball Lightning (Budapest 26–29 June 1990, organized by G. Egely and Y.-H. Ohtsuki)

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Two years after the First International Symposium on Ball Lightning in Tokyo, 25 investigators from 10 countries gathered in Budapest for presentations and discussions on ball lightning research. The topics covered recent photos and video registrations, new data and survey analysis, laboratory reproduction experiments, and theoretical model calculations. The conference listed classification standards and formed an international ball lightning committee with S. Singer (Pasadena) as president, Y.-H. Ohtsuki (Tokyo) and B. M. Smirnov (Moscow) as vice-presidents, G. C. Dijkhuis (Holland) as secretary, and G. Egely (Budapest) and Y.-S. Zou (Beijing) as members. The next symposium is scheduled for 1992 in the USA.

The video registrations showed reported ball lightning damage in Hungary (G. Egely), mysterious luminous objects above Hessdalen valley in Norway (E. Strand), and a red ball during a thunderstorm in England (T. Meaden, R. C. Jennison). Photographs and eyewitness reports documented ball lightning effects in Siberia (V. I. Lunev), and its trajectory behind an airplane (N. I. Galdukov). An English eyewitness reporting a bluish-white ball lightning from a TV aerial during a thunderstorm was questioned within 3 hours of the event by a perception psychologist (R. T. Green). A round-table discussion listed elements for defining ball lightning relative to other transient luminous phenomena in the atmosphere (W. H. Parkinson).

The Soviet ball lightning survey expanded to 5329 observations and correlated diameter with lifetime, and St. Elmo's fire with ball lightning parameters (A. I. Grigoryev). Over 2000 Japanese reports correlated ball lightning with death (Y.-H. Ohtsuki). Some 3500 Chinese ball lightning observations mostly occurred in fair weather (Zou Y.-S.). Diameter, lifetime and luminosity probabilities in published surveys followed log-normal distribution known from lightning parameter statistics (G. C. Dijkhuis). Atmospheric neutron generation attributed to lightning bolts actually preceded the discharge in some cases (N. Hawkins). Chemical ball lightning experiments continued, and microwave experiments began in Japan, producing combustion fireballs lasting 1–2 sec. in air mixed with methane and cotton fiber, and Kapitza-type plasma discharges in a half-open cylindrical cavity fed by 12.2 cm microwaves at power 1–5 kW, both recorded on photos and video (Y.-H. Ohtsuki and H. Ofuruton). In the US, replication of Tesla's early ball lightning experiments with his high-voltage RF coil resonator downscaled to 67 kHz and 3.2 kW, resulted in full-color photographs of cm-size fireballs fed intermittently for some seconds by forked steamers emanating from a copper or charred wooden electrode extension, with one ball passing through a glass windowpane on a video frame sequence (K. L. Corum and J. F. Corum, presented by G. C. Dijkhuis). Laser ablation experiment on copper plate formed tissue-like structure resembling hard-particle framework in fractal cluster model for ball lightning (B. M. Smirnov).

Theoretical contributions argued for the classical hydrodynamical Hill vortex model (K. Nickel) and its MHD relative with Tokamak-like geometry (Wu, H.-M.), and for a single polar magneton inside ball lightning (Bin K.-X.). A helical path in cartesian space-time for ball lightning produced a phase-locked cavity solution with nodal structure as seen on the red ball video registration (R. C. Jennison). Large, UFO-type ball lightning could come from maser action of rotating water molecules with energy levels inverted by ionospheric currents (P. H. Handel). A semi-classical plasma whirl model connected Hall-effect MHD for ions with Ramsauer transparency for wave-like electrons moving through air and hydrocarbons (E. A. Witalis). Pseudo-potential theory for exchange and correlation effects suggested a Mott-type insulator-metal transition of excited atoms in cold, dense plasma could form a semiconductor-like electron-hole liquid (P. P. Poluektov). Fermion theory for conduction electrons with exchange interaction established a triple point of thermodynamic equilibrium with Bose–Einstein ground state of superconducting electron pairs at average ball lightning temperatures (G. C. Dijkhuis and R. Struijs). Chemical combustion process in fractal cluster model gave spotted structure for ball lightning luminosity (B. M. Smirnov).

The continuing challenge of ball lightning spawned private research companies in the USA and The Netherlands, and national research programs at Information Centers in the USSR, Japan, and China. Laboratory reproduction of small, short-lived ball lightning with high-voltage, microwave and combustion facilities is now operational in the USA and Japan. By selection and integration of useful contributions from fluid dynamics, electromagnetism, plasma and MHD models, atomic and nuclear physics, statistical mechanics, quantum theory, relativity, and fractal studies, we expect that a consensus model for ball lightning will finally evolve in the present decade.

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