Report on the Third International Symposium on Ball Lightning (Los Angeles 28–30 July, 1992, organized by S. Singer)

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Geert C. Dijkhuis, Secretary, International Committee on Ball Lightning, Holland. In the bi-annual sequence following Tokyo 1988 and Budapest 1990, the Third International Symposium on Ball Lightning gathered 26 investigators from 9 countries in the pleasant setting of Sunset Village Conference Center at the University of California in Los Angeles. Twenty more scientists, including seventeen from Russia, submitted articles to be read at the Symposium, and for publication in the Proceedings. Symposium sessions focussed on observational data analysis, video recordings, modeling, and critique of reports and theories.

The International Committee on Ball Lightning formed in Budapest met and retained S. Singer (Pasadena) as president, Y.-H. Ohtsuki (Tokyo) and B. M. Smirnov as vice-presidents, G. C. Dijkhuis (Holland) as secretary, and Y.-S. Zou (Beijing and Hawaii) and G. Egely (Budapest) as members. Syposium participant E. A. Manykin from the Kurchatov Institute in Moscow stood in for B. M. Smirnov as Russian representative at the committee meeting. As organizer of the Los Angeles meeting, S. Singer will edit submitted articles for publication in printed symposium proceedings. For the next international symposium, the committee explores options in Beijing or Zagorsk near Moscow in 1994.

Communications by non-attendant authors were read in appropriate sessions either by S. Singer or G. C. Dijkhuis; they are marked respectively with rs and rd underneath. Two contributions from Russia arrived too late for presentations at the Symposium, but will be included in the Proceedings.

The first session started with statistical analysis of survey data from three continents connecting observable and structural ball lightning parameters with universal turbulence and random walk constants through differentiable fractal curves for self-scaling vortex stretching (G. C. Dijkhuis). A data bank on MS-DOS format combines Russian and other survey data for analysis with a personal computer. (A. Kh. Amirov, V. L. Bychkov and A. Yu. Stridjev, rs). Fractal fibres formed by laser irradiation of metallic surfaces provide basis for fractal concept of ball lightning (B. M. Smirnov, rd). Field investigation, expert testimony and image enhancement by computer identify light traces recorded during a thunderstorm on an Austrian photograph as a probable ball lightning event (A. G. Keul, rd). On two scintillation counters installed at the mountaintop lightning research facility of the Langmuir Laboratory in New Mexico, nearby lightning impacts failed to produce gamma radiation events as reported earlier from England by Ashby and Whitehead (D. Fryberger).

The fireballs and microwaves session chaired by Prof. N. Kitagawa presented videotaped wind effects on interfer-

ence plasma fire in the 5 kW Japanese microwave facility with an improved cylindrical cavity resonator (Y.-H. Ohtsuki, H. Ofuruton and N. Kondo). Resonant mode dependence on cavity geometry was calculated for elliptical cavities (H.-M. Wu), along with general microwave theory for ball lightning (A. P. Veduta, rd). For cavity resonance in a spherical shell geometry, some microwave modes trapped between a solid core and ponderomotive surface forces decay with time scales matching observed ball lightning lifetimes (D. B. Muldrew).

The second symposium day started with a session presenting various video records of field investigation and laboratory reproduction efforts. Unknown atmospheric lights in Norway on video and photographs seem associated with circular tracks found in snow with sub-normal bacterial content (E. Strand). Color photographs and video frame sequences of Corum and Corum's laboratory fireball reproduction with rf high voltage from a tesla coil shown at the preceding symposium drew critical comments (P. A. Silberg, rs; R. Golka). A full-fledged experimental demonstration combining microwave equipment with a vacuum chamber showed the symposium audience a stable, bluish, fist-size spherical discharge at 3 kW and 13.56 MHz between flat electrodes in low-pressure air, with a claim of up to 30% excess power generation "from the vacuum" (K. Chukanov, G. Genov and A. Martinov). A second "exotic" energy generation scheme treated ball lightning as a convertor of environmental heat, without apparent experimental support (S. A. Sall, rs). A contribution on volcanic ball lightning ended the video session (E. D. Bach).

In the ensuing theory session chaired by P. H. Handel, a hypothetical magnetic monopole acquired the observed properties of ball lightning (V. K. Korshunov). Electromagnetic theory for long-lived plasmoids from rail gun and laser ablation experiments resulted in a time-harmonic and force-free solution of Maxwell's equations with parallel electric and magnetic fields stabilized by helical vortex motion. (J. Nachamkin). Quantum-mechanical exchange interaction between electrons in excited atoms explains ball lightning as cluster aggregations of an atomic condensate termed "Rydberg matter" (E. A. Manykin, M. I. Ojovan and P. P. Poluektov). Quantum limits on magnetic flux and vortex circulation confirm statistical correlation of lightning current and ball lightning diameter, giving light ions nuclear corotation velocities at reported ball lightning energies (G. C. Dijkhuis). Transient mode interference causing near-instantaneous displacement of microwave anti-nodes could explain atmospheric discharge plasma moving with UFO-like accelerations in some ball lightning reports (Y.-H. Ohtsuki). Observer reports document penetration of glass, passage through conductors, and division of ball lightning in two parts (A. I. Grigor'ev, I. D. Grigoryeva and S. O. Shiryaeva, rd).

The third and final symposium day opened with a session focussing on critique of ball lightning reports and theories, with Y.-S. Zou as session chairman. A compact classification scheme categorizing credibility, accuracy and damage effects in ball lightning communications could forward the merger of existing data bases into an international ball lightning archive (R. C. Jennison). Maser-caviton theory obtains ball lightning energy from excited states of rotating water molecules, explaining harmless decay of domestic balls, frustration of would-be mountain top observers, and explosive decay of outdoor balls with material damage by a "spiking process" (P. H. Handel). A videotaped demonstration of DC short-circuit experiments showed luminous spheres of molten metal floating on water some seconds after current interruption between submerged electrode (R. K. Golka).

The closing symposium session returned to theories of ball lightning, with R. C. Jennison as chairman. Electric field line reconnection in weak-field cusp regions of dusty or dirty plasma environment forms ball lightning and english "crop circles" as electro-hydrodynamic spiral vortex structures, with weather-dependent helicity from prevailing local field direction (H. Kikuchi). Exploding wires were presented as an analogy of ball lightning (L. Steinert). Microwave fields trapped inside a 4000 K equilibrium plasma surface have amplitude-dependent collisional damping rate compatible with observed ball lightning lifetime (X. Z. Zheng). Resonant acoustic and plasma waves in atmospheric discharges from pointed objects form UFO-type ball lightning and tesla-coil fireballs as turbulent vortex soliton solution of a non-linear Schrödinger equation (Y.-S. Zou). Electro-hydrodynamic instability of charged droplets in a non-uniform electric field forms ball lightning by a repetitive break-up process cascading down to microscopic droplet size (A. I. Grigor'ev, I. D. Grigoryeva, S. O. Shiryaeva and A. A. Zemskov, rd).

A post-symposium paper to be included in the Proceedings, verifies formation of microscopic fractal cluster condensate by rapid cooling of metal jets emanating from a high-voltage discharge nozzle (S. I. Igolkin and S. K. Savelyev). The second late-arrival treats ball lightning as a bipolar charged shell of water molecules ordered into an electrostatic bubble (A. I. Mesyanishin).

The day after the formal symposium sessions, remaining participants attended a ceremony in the City Hall, where Mayor Rick Cole, on behalf of the City Council, proclaimed Friday, 31 July 1992 BALL LIGHTNING DAY in Pasadena. An afternoon visit to the celebrated Huntington Museum and Garden preceding a mexicanstyle dinner hosted by Dr. and Mrs. Singer, ended the Third Symposium on Ball Lightning in the classical tradition.

This orginal English text, a slightly condensed translation of which appears in Usp. Fiz. Nauk, was kindly supplied by G. C. Dijkhuis.