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**Free-floating atmospheric pressure ball plasmas** G.A. WURDEN, C. TICOS, Z. WANG, Los Alamos National Laboratory, C.J. V. WURDEN, Los Alamos High School — A long-lived (0.3 second, 10-20 cm diameter) ball plasma floating in the air above a water surface has been formed and studied in the laboratory. A 0.4 - 1 mF capacitor is charged to 4-5 kV, and subsequently discharged (30-60 Amps, 20-50 msec duration) into central copper cathode held fixed just below the surface of a bucket of water (with a weak solution of various salts in distilled water, such as CuSO<sub>4</sub> or CuCl<sub>2</sub>, LiCl or NaCl). An underwater ring anode completes the circuit. A bubble of hot vapor from the water surface rises up in the first few milliseconds, and changes from a mushroom cloud with stalk, to a detached quasi-spherical object, finally evolving into a vortex ring. The plasma consists of ionized water vapor, with positive salts and OH<sup>-</sup> radicals, as well as molecular species, and it completely excludes nitrogen or oxygen from the rising plasma structure. A fine boundary layer is visible in orange, in contrast to a green ball interior when using Cu/CuSO<sub>4</sub>, and filamentary structures are visible at late times. Finally, a whisp of smoke ring is observed as a residue. A variety of visible and infrared imaging (both video and still cameras) are used, along with 200-800 nm time & space resolved spectroscopy, to identify features of this laboratory analog to ball lightning. Possible applications include a windowless ball- plasma powered pulsed copper vapor laser operating at 510 nm.

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