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Further Insight into the Nature of Atmospheric Water Plasmoids[1]

MATTHEW JACOBS, WALTER GEKELMAN, PATRICK PRIBYL, Basic Plasma Science Facility at UCLA — There is a great deal of interest in pulsed atmospheric plasmas for applications in plasma chemistry, medicine and others. Here we study a plasma formed by a pulsed discharge (250 kW – 1,350 kW) in water. In previous studies, a high-voltage capacitor bank was discharged between a cathode protruding from a container of weakly conducting electrolyte (Stelmashuk, Vitaliy & Hoffer, P., IEEE, Trans. Plasma Sci, 2017) and a submerged ring anode. A plasmoid was produced and its light emission was photographed using a fast camera. This work extends these studies with the imposition of a magnetic field (100 G <B <2 kG) parallel to the cathode. The long-lived plasmoid (t >1 sec) was photographed with a fast framing camera (30,000 frames/sec). The highly collisional plasma was observed to rapidly rotate when the field was present. B-dot probes with onboard electronics and no connection to ground measured coherent low frequency fluctuations (f = 50 Hz), which became chaotic at larger input powers. The photography revealed "firefly" streamers that drift away from the mushroom cloud above the spinning vortex. Aside from movies we present data from magnetic probe arrays, plasma density measurements and spectra.

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