Abstract Submitted
for the GEC12 Meeting of
The American Physical Society

Slow Lightning in Water Plasmoids[1] KARL STEPHAN, SHELBY DUMAS, JONATHAN MCMINN, Ingram School of Engineering, Texas State University-San Marcos — Water plasmoids are produced when a capacitor is discharged into a cathode at the surface of a weakly conducting water electrolyte. The resulting plasma jet forms a glowing spherical plasmoid which persists in air for up to 0.3 s and resembles ball lightning in some respects. This study shows that during the plasmoid's formation stage, surface discharges with unusual characteristics carry the large instantaneous discharge current. The liquid-surface discharges have some characteristics of both conventional solid-surface discharges (branching, fractal structure) and glow discharges (approximately constant current density from the discharge plasma to the water surface over a wide range of current). Dynamically, the surface discharge resembles a two-dimensional version of a lightning leader, but develops at much lower speeds: a maximum of about 0.3 m/s for the surface discharges in this study, compared to lightning leader speeds of 100 to 100,000 m/s. The low conductivity of the water used (about 20 mS/m) means that the surface discharges are interacting with a resistive barrier, which allows a significant tangential electric field on the surface. High-speed photography of the discharges is supplemented by spectroscopic and other experimental studies.

[1]The authors acknowledge support provided by a Texas State University 2012 Research Enhancement Grant.

Karl Stephan
Ingram School of Engineering, Texas State University-San Marcos

Date submitted: 13 Jun 2012 Electronic form version 1.4