Abstract Submitted
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Plasma charging and electron-based reactions at the plasma-liquid interface of an isolated liquid droplet[1] PAUL MAGUIRE, CHARLES MAHONY, COLIN KELSEY, DAVID RUTHERFORD, DAVIDE MARIOTTI, Ulster University , DECLAN DIVER, University Of Glasgow — The study of plasma-liquid interactions opens up exciting new opportunities for applications but numerous investigative challenges remain. The use of isolated and stable spherical liquid microdroplets in a non-thermal equilibrium atmospheric pressure plasma offers a new platform for experimental and theoretical investigations. Since the droplet assumes floating potential, a high flux of electrons with low net energy (˜thermal) becomes fixed and solvated within the first monolayers of the liquid leading to highly reactive and rapid chemical reactions. We observe such reactions, e.g. H2O2 and metal nanoparticle formation, at rates that are much higher than reported elsewhere. Since the isolated droplet radius is greater than Debye lengths and mean free paths, we have an opportunity to directly compare, for the first time, long-standing collisional probe theories in this important regime. We measure a lower bound average charge of >1E5 electrons on a 13um droplet. Simulations of unipolar corona charging for this size predict ˜1E3 electrons. A Comsol-based drift-diffusion model is currently under development and so far experiment and theory match within ˜1 order of magnitude but improvements in measurement technique are in progress.

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