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Measurement of Electric Fields in Radio Frequency Argon Discharges[1]

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We present a summary of our measurements of electric fields present in the sheath region formed between an electrode and a radio frequency generated argon plasma. Experimental calibrations for several Stark shifted argon Rydberg states are presented. Desired field resolution and field range are shown to be dependant on the choice of Rydberg level probed. For example, the 11d[1/2] level can be used for fields exceeding 5000 V/cm while the behavior of Rydberg states around 38n push detection sensitivities down to the V/cm level. Both spatial and temporal maps of the electric fields are presented for sheaths formed around several electrode configurations. Electrode configurations studied range from complex topologies present on a powered electrode to thin metallic wires (Langmuir probes) present in the bulk of the discharge. Discussion will be offered on the effect of the electrode structure on the resulting field structure as well as the resulting behavior of the discharge around the electrode. When possible, comparison between the measured sheath structure and expected sheath structure will be made. This work was supported by the Division of Material Sciences, BES, Office of Science, U. S. Department of Energy and Sandia National Laboratories, a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

[1]In collaboration with Greg Hebner, Sandia National Laboratories