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Chaotic behavior in atmospheric pressure barrier discharges JAMES WALSH, FELIPE IZA, NATALIA JANSON, MICHAEL KONG, Loughborough University — Atmospheric pressure discharges are an essential tool in many emerging industrial and biomedical applications.[1] To ensure process repeatability, it is critical to have a clear understanding of the discharge physics which in-turn allows the implementation of a control strategy. Recently, experimental work investigating dielectric barrier helium plasma jets highlighted the potential for chaotic behavior over a wide range of input powers.[2] Here we extend that work and examine the manifestation of chaotic behavior in a parallel plate discharge operated in both helium and argon gas. The power spectral density, phase-space representations and Poincaré sections are used to characterize the dynamics of the system and to obtain a deeper insight into its chaotic behavior. By examining two variables, namely the discharge current and electrode spacing, it is possible to map regions of chaotic, quasi-periodic, and periodic behavior over a wide range of operating conditions, providing an indirect control strategy to ensure a repeatable operation. The origins of chaotic behavior and the possible routes to chaos are examined using time resolved electrical and optical diagnostics and this information can be used to implement advanced control strategies. [1] Morfill *et al.* New Journal of Physics 11 (2009) 115011 [2] Walsh *et al.* J. Phys. D: Appl. Phys. 43 (2010) 075201 (14pp)

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