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Chaotic and periodic dynamics of a hovering Quincke rotor[1] GERARDO PRADILLO, Georgetown University, HAMID KARANI, Brown University, MATTHEW OLINE, PETIA VLAHOVSKA, Northwestern University — The Quincke effect is an electrohydrodynamic instability which gives rise to a spontaneous rotation of a charge–free dielectric particle in a uniform DC electric field. The equations describing the dynamics of a sphere have been previously mapped onto the Lorenz equations (Lemaire and Lobry (2002)). Experiments have shown the existence of a bifurcation at high electric fields in which chaotic rotation around a fixed axis occurs (Peters et al, Chaos (2005)). In this talk we describe the there-dimensional dynamics of the Quincke rotor using the hovering Quincke state (Pradillo et al, Soft Matter (2019)). We experimentally discover three-dimensional chaotic motion, which allows abrupt changes in axis of rotation, and periodic dynamics characterized by a constant re-orientation of the axis of rotation, coupled with time dependent oscillations. Noisy periodicity has been predicted for the Lorenz system (Sparrow 1982). We develop a fully three-dimensional model to describe the observed dynamics.

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