Dynamics and stability of a 2D ideal vortex under external strain[1]

N. C. HURST, J. R. DANIELSON, D. H. E. DUBIN, C. M. SURKO, University of California - San Diego — The behavior of an initially axisymmetric 2D ideal vortex under an externally imposed strain flow is studied experimentally [1]. The experiments are carried out using electron plasmas confined in a Penning-Malmberg trap; here, the dynamics of the plasma density transverse to the field are directly analogous to the dynamics of vorticity in a 2D ideal fluid. An external strain flow is applied using boundary conditions in a way that is consistent with 2D fluid dynamics. Data are compared to predictions from a theory assuming a piecewise constant elliptical vorticity distribution [2]. Excellent agreement is found for quasi-flat profiles, whereas the dynamics of smooth profiles feature modified stability limits and inviscid damping of periodic elliptical distortions. [1] N. C. Hurst, et. al., Phys. Rev. Lett. 117, 235001 (2016). [2] S. Kida, J. Phys. Soc. Japan 50, 3517 (1981).

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