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Generic Hydrodynamic Instability

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Every fluid dynamicist knows that almost all 3-d steady incompressible inviscid fluid flows are unstable; however, very few rigorous results about generic instability exist. Our idea is to use the geometry of the flow domain as a parameter. We prove that for generic geometry, *all* of the curl-eigenfield solutions to the steady Euler equations on R^3 (with periodic boundary conditions) are hydrodynamically unstable (linear instability, L^2 norm), with the possible exception of the zero-eigenvalue solution. The proof involves a marriage of topological methods with the instability criteria of Lifshitz-Hameiri and Friedlander-Vishik. An application of a new homology theory in symplectic geometry is the crucial step.

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