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Origin and stability of radial density stratification in vortical flow
HARISH DIXIT, RAMA GOVINDARAJAN, EMU, JNCASR, Bangalore — A density interface near a vortex winds into a spiral. In the absence of gravity we have shown numerically and through stability analysis that this leads to spiral Kelvin-Helmholtz and centrifugal Rayleigh-Taylor (CRT) instabilities, often reducing the life-time of the vortex dramatically. In this talk we focus on CRT instability, which is driven by centrifugal forces, so flows where the vortex core is heavier than the surroundings are expected to be unstable. Indeed, Sipp et al. (JFM, 2005) and Joly et al. (JFM, 2005), prescribing Gaussian vorticity and density profiles, find no instability in light-cored vortices. Surprisingly however, for some range of parameters, with a Rankine vortex and a step circular density jump we find that making the core lighter can lead to instability. The sharpness of the profiles are thus relevant. The mechanism for this instability, studied by constructing planar analogues in the form of stratified shear flows, bearing similarities with Craik & Adams (JFM, 1979), will be discussed. So will the nonlinear stages of these instabilities from our direct numerical simulations.

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